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# USSR Report

SCIENCE AND TECHNOLOGY POLICY

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20 August 1985

## USSR REPORT

### SCIENCE AND TECHNOLOGY POLICY

#### CONTENTS

##### ORGANIZATION, PLANNING AND COORDINATION

Introduction of Results of Dissertations on Pharmaceuticals (A. I. Tentsova, et al.; FARMATSIYA, No 1, Jan-Feb 85) ..	1
Registration of Introduction of Scientific Achievements (S. Ivanyushin; KHOZYAYSTVO I PRAVO, No 3, Mar 85) .....	12
Organization of Research in Pharmaceuticals (A. I. Tentsova, et al.; FARMATSIYA, No 6, Nov-Dec 84) ..	16
Work of Ukrainian Board of Scientific Economic Society (G. Dzis'; EKONOMIKA SOVETSKOY UKRAINY, No 4, Apr 85) ...	22
Plenum of Ukrainian Board of Economic Science Society (L. Omel'chenko; EKONOMIKA SOVETSKOY UKRAINY, No 4, Apr 85)	31

##### BUDGET AND FINANCE

Regulation of Financing of Scientific, Technical Developments (B. Mints; KHOZYAYSTVO I PRAVO, No 4, Apr 85) .....	32
Problems of Stimulating Scientific, Technical Development (M. V. Romanovskiy; FINANSY SSSR, No 4, Apr 85) .....	42
Use of Funds for Scientific, Technical Development (Ye. A. Stoyanov; FINANSY SSSR, No 4, Apr 85) .....	53

##### FACILITIES AND MANPOWER

New Latvian Development Firm Described (Ye. Vostrukhov, A. Ivakhnov; IZVESTIYA, 30 Apr 85) .....	59
Integrated Science-Production Organization in Lithuanian Viewed (A. Zhukauskas; SOTSIALISTICHESKAYA INDUSTRIYA, 18 May 85)	63

More Effective Use of Young Scientists Urged (S. Kolesnikov; KOMSOMOL'SKAYA PRAVDA, 27 Apr 85) .....	67
TRAINING AND EDUCATION	
Role of Belorussian Vuzes in Science, Economy Traced (B. Kaledin; SOVETSKAYA BELORUSSIYA, 21 Apr 85) .....	70
Organization of Research on Secondary Specialized Education (A. Ya. Savelyev; SREDNEYE SPETSIALNOYE OBRAZOVANIYE, No 3, Mar 85) .....	74
Research Problems in Higher, Secondary Specialized Education (SREDNEYE SPETSIALNOYE OBRZOVANIYE, No 3, Mar 85) .....	81
Progress, Plans of New Moscow Laser Institute Described (V. Yevseyev; PRAVDA, 30 May 85) .....	88
AUTOMATION AND INFORMATION POLICY	
Evaluation of Quality of Technical Decisions in Designing (A. V. Bazhenov; STANDARTY I KACHESTVO, No 3, Mar 85) ...	90
Academician Frolov Reviews Future Use of Robots, Automated Plants (K. V. Frolov Interview; NEDELYA, No 16, 15-21 Apr 85) ..	99
INDUSTRIAL AND MILITARY APPLICATION	
Standardization in Small-Series, Custom Production (A. L. Vasil'yev; STANDARTY I KACHESTVO, No 3, Mar 85) ..	106
Polimer Specialist Interviewed on New Products, Applications (N. Yenikolopov Interview; SOTSIALISTICHESKAYA INDUSTRIYA, 14 Apr 85) .....	114
PATENTS AND INVENTIONS	
Development of High-Precision Laser Clock Traced (Ye. Solomenko; PRAVDA, 27 May 85) .....	117
Better Use of Technical, Patent Information Urged (L. Shchelkanovtsev; EKONOMICHESKAYA GAZETA, No 22, May 85)	119
Greater Role for Invention- in Increasing Efficiency Urged (Editorial; SOTSIALISTICHESKAYA INDUSTRIYA, 24 May 85) ..	121
CONFERENCES AND EXHIBITION	
Moscow Meeting on Introducing Science Into Production (SOTSIALISTICHESKAYA INDUSTRIYA, 21 Apr 85) .....	124



## GENERAL

Academician Koptug Interviewed on Siberian Science (V. A. Koptug Interview; TRUD, 21 Apr 85) .....	129
Effectiveness of Integrated Research--Development Traced (Yu. Pozhela; PRAVDA, 26 May 85) .....	132
Academician Describes Achievements of Estonian Science (S. Kalabin; SOVETSKAYA ESTONIYA, 20 Apr 85) .....	135
Advances of Moldavian Agricultural Science Reviewed (SOVETSKAYA MOLDAVIYA, 20 Apr 85) .....	137

## ORGANIZATION, PLANNING AND COORDINATION

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### INTRODUCTION OF RESULTS OF DISSERTATIONS ON PHARMACEUTICS

Moscow FARMATSIYA in Russian Vol 34, No 1, Jan-Feb 85 pp 1-8

[Article by A. I. Tentsova, K. D. Sedova, S. F. Vasil'yeva, S. D. Ivanova and N. S. Tereshina, the All-Union Scientific Research Institute of Pharmaceutics (Moscow): "The Introduction in Health Care Practice of Dissertations Which Were Performed on the Problem 'Pharmaceutics'"]

[Text.] The proper understanding of the essence of the directions and means of introduction is one of the most important questions of the present, with which the strategy of the development of science and technology and of the entire national economy is connected.

The results of the completed research, which was performed on the problem "Pharmaceutics" of Scientific Council No 10 "Pharmacology and Pharmaceutics" of the USSR Academy of Medical Sciences, attest that in recent years large changes have occurred in the structure of research, the theoretical level of the performed work has increased and its introduction has been intensified. This can be shown especially clearly on the basis of the example of the doctoral and candidate dissertations, which were defended in 1976-1982.

During this period 32 doctoral and 268 candidate dissertations were defended and were approved by the USSR Higher Certification Commission (see the table).

The analysis showed that 44 percent of the dissertations were defended in the specialty "The Technology of Medicines and the Organization of Pharmaceutics" and 54 percent were defended in the specialty "Pharmaceutical Chemistry and Pharmacognosy."

The defended dissertations are of a theoretical and applied nature, this also determines the content of their practical recommendations. In all 281 recommendations were suggested for introduction, of them 201 were introduced, which comes to 71.5 percent. The level of the introduction of dissertation research in health care practice is quite high, at the union level 24.5 percent of the completed works were introduced, at the republic level--33 percent and at the oblast (kray) level--36.7 percent. Thus, the obtained data attest that by the time of the defense of the dissertation the recommendations for the most part had been introduced in practice and encompassed new classes of compounds, medicinals, new medicinal forms,

efficient technology, new methods of analysis, improved medicinal forms, procedural recommendations and instructions, orders, certificates of authorship, pharmacopoeial articles, monographs, educational methods handbooks and participation in displays at the Exhibition of National Economic Achievements and other exhibitions.

Dynamics of Dissertations Defended in 1976-1982  
(I--doctoral; II--candidate)

Year	Number of dissertations by direction							
	technology of medicines		organization of pharmaceuticals		pharmaceutical chemistry		pharmacognosy	
	I	II	I	II	I	II	I	II
1976.....	-	2	-	1	-	5	-	3
1977.....	1	14	-	4	1	11	-	6
1978.....	-	13	1	6	3	12	-	6
1979.....	2	10	-	7	1	22	-	12
1980.....	3	15	1	3	2	18	-	6
1981.....	2	18	-	3	8	16	2	7
1982.....	1	12	-	2	3	16	1	8
Total.....	9	94	2	26	18	100	3	48

The majority of dissertations on the technology of medicines were aimed at the conducting of biopharmaceutical research, which promotes the development of efficient, effective stable medicinal forms with a high biological accessibility.

On the basis of biopharmaceutical research the means of developing combined ointments on a water-soluble base for the treatment of purulent wounds, which in their antimicrobial action surpass by 20- to 80-fold similar ointments on a vasoline-lanolin base, were proposed and substantiated theoretically. The ointments underwent clinical tests and were recommended for medical use. The advisability of the development of polymixin and neomycin ointments on the basis of polymer carriers (methyl cellulose and sodium-carboxymethyl cellulose gels) was substantiated scientifically and experimentally.

At present the problem of an efficient technology of suppositories, which have a high therapeutic action and are used especially for children and elderly people, is urgent. Doctoral and candidate dissertations have been completed in this direction. The important theoretical problem of establishing the principles of the optimization of research on the development of highly effective rectal medicinal forms has been solved. The criterional values of the structural-mechanical parameters of lipophilic bases and oleogels were derived for the first time, which creates the prospect of the control of their elastoplastic-viscous properties and the regulation of the intensity of technological processes. As a result of comprehensive research the formula and technology of suppositories with corglycon, which were recommended for medical use, were developed. The rectal medicinal forms of corglycon ensure a higher level of their biological accessibility as compared with peroral forms. The clinical tests of the gas-forming suppositories Kal'tsilaks and Ferrolaks

and suppositories with senna extract have been completed and permission for their use in medical practice has been received. The technology of suppositories with soluble isoniazide and saluzide, antibiotics with vitamins and enzymes, vaginal suppositories with sex hormones, suppositories for children with diphenylhydramine and others has been developed.

Tablets are the most prevalent medicinal form. However, all the contradictions of the factors, which determine the action of the basic medicinal substance, are incorporated in the tablet, therefore the study of the interconnection between the physical chemical, technological and biological properties of tableted substances and the influence of the process of tableting on the biological accessibility of medicines is being intensified. A number of dissertations have been fulfilled in this direction.

A technology of tablets of hydrochloride anabesine, feramide, megasen, batriden, cobalt-30, kupir and others was developed on the basis of the study of the physical mechanical and volumetric technological properties of tableted compounds. Using mathematical models, the dependence of the quality of tablets on technological factors and the conditions of the conducting of an experiment was established, scientifically sound recommendations on the improvement of the technology of producing 25 descriptions of tablets were given and the qualitative indicators of series-produced products were improved. A large economic impact from the introduction of these recommendations with the significant improvement of the quality of tablets was obtained.

The recommendations on the use of high-molecular compounds and film-forming compounds made many changes in the process of tableting. A technology of the film coating of mebikar tablets with ethylcellulose and hydroxypropyl methyl cellulose, which ensure stability and the correction of the bitter taste, has been developed. Recommendations on the technology of the suspension method of coating tablets of allochol, raunatin, valerian extract, ferrocil, lecithin-cerebro and rheopyrine were introduced at pharmaceutical chemical plants. The changeover of the entire range of coated tablets to the suspension method of coating will yield an economic impact.

The technological conditions of obtaining granules of single- and multiple-component medicinal preparations in units with a fluidized bed like the SG-30 have been developed. The calculation showed a significant economic effectiveness from the introduction of the units in a fluidized bed.

The works on the technology of low-temperature processing with subsequent drying by lyophilization were of problem importance. The theoretical principles of low-temperature preservation were studied, and a technology of the freeze drying in a vacuum of thermolabile preparations: lipase, urease, tripartan, adipinate serotonin and others, was developed. The technology of lyophilic drying on the recommendation of the author is being used under the production conditions of the Ministry of the Medical Industry, the ministries of health, the USSR Ministry of Agriculture and others.

A number of dissertation investigations were devoted to the study of synthetic polymers for the purpose of their use in pharmaceutical practice. The



possibility of using polyorganosiloxanes in pharmaceuticals was substantiated theoretically and was confirmed experimentally. On the recommendation of the All-Union Scientific Research Institute of Pharmaceuticals the chemical industry is carrying out the production of two new brands of polyorganosiloxane liquids for medical purposes--esilon-4 and esilon-5--in accordance with the corresponding all-union state standards. The priority of the investigations is confirmed by four certificates of authorship. The new preparation mastisan E (an erythromycin sulfadimesine suspension based on esilon-5) for veterinary use has been developed, its industrial production has been implemented.

The interest in biological polymers, in the possibilities of their combination with synthetic polymers and in the development on their basis of various preparations for medical purposes has increased. Of the numerous polymers the most promising is collagen--the basic fibrillar protein of connective tissue. Among the most significant studies in this direction one should note the development of a method of obtaining highly porous collagen foams and films: collagen film with 1 percent sea buckthorn oil, film and foam with 5 percent methyl uracil and the collagen imitator of skin thymus nucleic acid. The possibility of the extensive use of collagen in medicine, particularly for the development of vascular prostheses, was established. The research on the technology of collagen preparations and items for medical purposes is protected by eight certificates of authorship and three patents. The laws of the influence of various methods of reducing collagen on its structure and physical chemical properties have been substantiated theoretically. The optimum method of reduction, which makes it possible to preserve the native nature of the structure of collagen molecules and to increase its swelling ability, has been determined. The composition and technology of six prescriptions of medicinal forms based on collagen (ointments, solutions for injection, intra-ocular film) have been developed.

In recent times a new direction has appeared--the use of enzyme systems in the method of hemosorption, which is affording new prospects in the treatment of a large number of diseases. An enzyme preparation of urease, which is used as a medium for the catalytic hydrolysis of the dialyzing fluid in artificial kidney machines, as well as for diagnostic purposes for the determination of the concentration of urea in biological fluids, has been obtained. The method of obtaining urease of a substance is protected by a certificate of authorship. The work on the further use of urease from watermelon seeds in a compact artificial kidney machine was included in the program of work of the State Committee for Science and Technology attached to the USSR Council of Ministers for 1981-1985.

New methods of realizing processes, which are standard for pharmaceutical chemical technology and take place in heterogeneous media, were substantiated scientifically, the theoretical principles of the work of rotary-pulse devices were generalized. The laws of the interaction of dispersed particles with the working elements of the device were examined in detail for the first time. The RPA-100 and RPA-160 devices are being introduced at domestic enterprises of the pharmaceutical chemical type and abroad (Bulgaria). The method of obtaining stable 20 and 40 percent suspensions of barium sulfate on the basis of aubazidan, which has been patented in the United States, France and



Finland, was developed for the first time with the use of rotary-pulse devices. The research is protected by 16 certificates of authorship.

A technology of obtaining suspension medicinal systems with allowance made for the strength of powders, which combines pulverization with the simultaneous mixing of the components by means of rotary-pulse devices and makes it possible to shorten the duration of the production cycle to one-half to one-fifth, was substantiated theoretically and developed. The economic effectiveness from the introduction of the developed technology (on the average for pharmaceutical chemical plants which produce soft medicinal forms) per device was calculated.

The question of obtaining such medicinal forms for injections as stable solutions in vials of sodium para-aminosalicylate, sodium salicylate in combination with caffeine-sodium benzoate with a long shelf life is no less urgent. The production of stable solutions for injections--a 3-percent solution of para-aminosalicylate in vials and 250-ml bottles, a solution of sodium salicylate with caffeine-sodium benzoate--has been introduced at pharmaceutical chemical plants. A new technology has been developed and the production of a number of solutions for injections in small bottles (waters for injections and a 0.9-percent solution of sodium chloride in 250- and 450-ml bottles, 5- and 40-percent solutions of glucose, 0.25- and 0.5-percent solutions of novocaine) has been assimilated.

The compositions and technology of multiple-component saline infusion solutions for the treatment of acute gastrointestinal diseases: Trisol', Disol', Atsesol', Khlosol', Kvartasol', were developed for the first time in our country. The solutions have been authorized for medical use and have been introduced in industrial production.

With respect to the organization of pharmaceuticals the defended dissertations are of great social importance and are aimed at the development of the procedural principles of the forecasting of the need for medicines, the organizational forms of the work of pharmaceutical institutions on the supply of medicine to the population and pharmaceutical information.

The studies of the multivariant forecasting of the need for hormonal and several other groups of preparations with the use of the methods of extrapolation according to the technique of least squares, exponential smoothing, harmonic scales, correlation-regression analysis and collective expert appraisal are interesting. Suggestions on the regulation of the range of hormonal preparations were given. The procedural instructions of the multivariant forecast of the need were approved by the Main Pharmaceutical Administration of the USSR Ministry of Health and were used when planning the need of the country for the 11th Five-Year Plan and to 1990.

A number of new procedural approaches to the study of the determination of the need for medicinals for the immediate and distant future for the oblasts of the Ukrainian SSR with the use of methods of mathematical statistics on the basis of the example of psychotropic, X-ray contrast, narcotic and other groups of medicinals and for the oblasts of the Uzbek SSR on the basis of the

example of analgesic, antipyretic and antiphlogistic preparations from the standpoint of a systems approach were developed.

Research was performed on the improvement of the process of managing the supply of antibiotics. A procedural approach to the identification of the degree of influence of the factors, which form the process of consumption, was developed, scientifically sound principles and procedural instructions, which are conducive to the improvement of the planning of the need for antibiotics and to their efficient use in health care practice, were recommended.

The studies on the procedure of transferring the pharmacies of preventive treatment medical institutions to the subordination of pharmaceutical administrations are of great importance. The means of the establishment and the organization of the work of these pharmacies were determined theoretically and procedurally. The basic laws, which influence the size of the stocks of medicines and other medical items, were identified and the mathematical model for their optimum distribution was calculated. A set of basic indicators of the economic activity of hospital cost accounting and interhospital pharmacies was recommended. The recommendations were approved by the USSR Ministry of Health and are the basis for the supply of inpatient hospitals with medicines through interhospital and hospital cost accounting pharmacies.

Other dissertations, which are aimed at the improvement of the organization of the control of the quality of medicines at the oblast level and the organization of the labor of the managers of pharmacies, at the development of a general methodological approach to the systematization of drug therapy information on the basic cardiovascular diseases and others, were also fulfilled.

In pharmaceutical chemistry 75 percent of the doctoral dissertations and 25 percent of the candidate dissertations were devoted to the synthesis of biologically active compounds. The attention of the researchers to questions of the development of new synthetic medicinals stems from the need for the elaboration of the theoretical principles of the dependence of the pharmacological action on the structure of the substance and for the obtaining of more effective and less toxic substances for the prevention and treatment of basic types of diseases.

The dissertation work, which was performed on the synthesis of biologically active compounds, along with the elaboration of basic theoretical questions of fine organic synthesis is also of an applied nature.

Unsaturated carbonaceous compounds--chalcones and their analogues, which serve as the parent substances for obtaining numerous derivatives of benzo-gamma-pyrone (flavonones, flavones, flavonoles)--are very promising from the point of view of structural peculiarities. Among the derivatives of chalcones a number of substances, which are superior in action to such antibiotics as penicillin, streptomycin and tetracycline, in capillary restorative action--to rutin and in antisclerotic action--to miscleron, were obtained. The obtained compounds are at various stages of introduction.

New methods of synthesizing analogues of natural isoflavones and their heterocyclic derivatives were developed and optimized. A computer program, which made it possible to forecast new compounds with a higher anti-atherosclerotic action, was compiled and used.

As a result of the purposeful synthesis of hexamethylene ammonium compounds about 50 compounds, which have a pronounced bactericidal action, were obtained. Of these compounds two preparations, which have an antiseptic action and are intended for the treatment of the hands of the surgeon and the operating room floor and for the sterilization of suture materials and rubber and plastic items, have been recommended for medical use.

During the past period over 4,000 new compounds, which were not previously described in the literature and from which 109 biologically active substances with antiproliferative, diuretic, neuroleptic, bacteriostatic and other types of action were selected and turned over for further pharmacological study, were synthesized. The scientific novelty and practical significance of the performed research are protected by 296 certificates of authorship. In all 37 new original preparations of an antiphlogistic, antimicrobial, hypoglycemic, antiviral, cholagogue, liver-protecting and other types of action were proposed.

In recent years the methods of analyzing substances and medicinal forms have become more perfect. Physical chemical methods, including optical methods, which account for 36 percent of the research, as well as chromatographic methods, including thin-layer, gas and gas-liquid chromatography, have come to the forefront. The interest in electrochemical methods: polarography, potentiometry and others, has increased noticeably.

One of the rapidly developing methods is ultraviolet spectroscopy, which makes it possible to identify compounds, to evaluate them quantitatively according to the physiologically active part of the molecule, as well as to determine the medicinal preparations in multiple-component mixtures.

Systems studies of the infrared spectra of carbonyl-containing medicinal preparations were conducted for the first time. The procedural aspect of the studies was taken as the basis when preparing a general pharmacopoeial article on infrared spectroscopy. The methods of identifying medicinal preparations, which are classified with steroids, amides and tetracycline antibiotics, were approved by the USSR Ministry of the Medical Industry as sectorial procedural instructions.

The elaboration of a set of physical chemical methods, including optical and electrochemical methods in combination with chromatography, is acquiring particular urgency for the analysis of multiple-component and phytochemical preparations, which often contain a number of substances of one or several classes with similar physical chemical properties. Such research makes up about 20 percent of the dissertations devoted to pharmaceutical analysis.

The basic research on the study of the chromatographic and optical properties of flavonoids, derivatives of coumarin and anthraquinone is a new direction in



pharmaceutical analysis when controlling the quality of phytochemical preparations and standard specimens.

A new method of evaluating thin-layer chromatograms according to the electrical resistance, which makes it possible to make the simultaneous qualitative and quantitative evaluation of the substance being analyzed, which shortens by several fold the time of analysis, has been proposed. The device for quantitative detection in plane chromatography is protected by a certificate of authorship.

The search for physical chemical methods of analysis for the replacement of biological tests is an urgent problem. A spectrophotometric method of the quantitative determination of pyrogenal in injection solutions, which was introduced in the plan of the FS [possibly--pharmaceutical standard] for the preparation "Liquid Medicinal Pyrogenal," was proposed for the first time. The method is protected by two certificates of authorship.

Kinetic methods, which are based on the measurement of the concentration of reagents or the depth of reaction in time, are a new direction in the area of pharmaceutical analysis. The testing for antioxidant action of medicinals, which contain phenol groups, was carried out by means of a model chain reaction of the induced oxidation of cumene. Methods of the quantitative determination of steroid estrogen hormones and their synthetic analogues were developed for the first time on the basis of this method.

In accordance with the results of dissertations on pharmaceutical analysis 18 certificates of authorship were obtained and 28 procedural recommendations were issued. The developed methods of analysis were included in 47 pharmacopoeial articles, plans of the FS and VFS [not further identified] and the list of changes to pharmacopoeial articles.

Of the defended dissertations on pharmacognosy about two-thirds were devoted to the identification of pharmacologically active substances in plants, which are of practical value for clinical medicine, as well as to the development of methods of their qualitative and quantitative analysis.

In a number of works theoretical assumptions on the variability of the biological composition of medicinal plants in ontogenesis are presented and the means of influence of various factors on the productivity of medicinal plants are shown.

As a result of the biochemical study of endemic plants of the Northern Caucasus--the alpine poppy and Liza poppy, the California poppy and plicated snowdrop--the raw material base for obtaining preparations was broadened. The alpine poppy was recommended as a source of the alkaloid protopine, which has an anti-arrhythmic action, while the Liza poppy was recommended for obtaining the alkaloid oridin with an antihyaluronidase effect. The California poppy was proposed as an additional raw material in the production of protopine, sanguinarine, glaucine and berberine.

On the basis of the comparative study of Central Asia's 'ungerniya' [not further identified] according to the basic stages of the life cycle of

plants and the influence of ecological and anthropogenic factors techniques and efficient times of procurement were established, methods of the standardization of medicinal raw materials and the pharmacologically active alkaloid galanthamine were developed. The method of standardizing raw materials was recommended in the FS.

A significant number of works were devoted to plants which contain polyphenols. A front comprehensive pharmacognostic study of 2 types of marigolds of 45 strains and 6 types of yarrow was conducted. More than 120 flavonoid compounds, on the basis of which 8 new medicinal preparations, which have a different pharmacological action, were developed, were extracted and identified.

In connection with the fact that the need for official types of medicinal plants is increasing and their reserves in nature are decreasing, a chemical biological study of vicarious types of St. John's wort, everlasting, plantain, adonis and others was conducted, which made it possible to recommend them in medical practice and thereby to broaden the raw material base.

As a result of the fundamental study of plants, which are used extensively in medicine, but with an inadequately studied chemical composition, biologically active substances were extracted and identified, objective methods of the evaluation of the quality of the grass of bog gnaphalium, the bark of the European high-bush cranberry, the leaves of coltsfoot, gourd seeds and others were developed.

In all 35 types of plants, which contain cardenolides, were studied, 49 steroid compounds were extracted, their structure was established, 15 substances proved to be new and previously not described in the literature. Original laboratory processing regulations for obtaining of alpha-acetyl digitoxin and lanatoside A from oiliate foxglove were developed. The method of extracting alpha-acetyl digitoxin was awarded a bronze medal of the Exhibition of USSR National Economic Achievements.

More than 1,000 types of plants from the flora of the Turkmen SSR, from which 337 types were selected for the fundamental chemical study of essential oils, coumarins and flavonoids, were studied. Samples of essential oils were obtained from 74 essential-oil plants and their physical chemical properties were established. In all 52 individual substances were distinguished. The essential oils were displayed at the Exhibition of USSR National Economic Achievements and were commended with a bronze medal. The identified connection of the optical and chromatographic properties of cardenolides, triterpinoids and furocoumarins with their structure made it possible to develop instrument methods of the standardization of plant raw materials and the stage-by-stage control of the production of a number of preparations and to include them in 23 standard technical documents.

For the broadening of the assortment of the varietal composition of medicinal plant raw materials of tropical and subtropical plants the possibility and economic advisability of the introduction into the crop of smooth stephany [stefaniya gladkaya], pink catharantus, incarnate passiflora and grayish rauwolfia were substantiated for the first time. These plants serve as a



source for obtaining a number of medicinal preparations: gyndarin, stefaglabrin, rosevin and passiflora extract. The preparation gyndarin has been patented in three countries (India, France and Switzerland).

The studies of the culture of rauwolfia tissues for the purpose of replacing imported raw materials are of definite urgency. As a result of the comparative study of various strains and cell lines of the culture of snake rauwolfia tissues a culture valuable in production--cell line A, which is characterized by a high content of alkaloids and a high productivity in case of the complete elimination from the culture medium of exogenous phytohormones, was extracted for the first time. Cell line A of the culture of snake rauwolfia tissues is being recommended for introduction in industrial production.

For the purpose of supplementing the assortment of means with an adaptogenous spectrum of action, which are so necessary for health care, the study of the culture of isolated tissues of the tropical plant fern-leaf polystichias [polistsias] was conducted for the first time. The conditions of the growing of callus tissue were formulated, two triterpene glycosides were extracted and identified. A tincture with a high stimulating and pronounced antistress action was obtained from the biomass of the strain of polistsias.

As a result of the performed dissertation work on the study of medicinal plants 46 original phytopreparations with a hypoglycemic, antiphlogistic, antimicrobial, cholagogue and liver-protecting action, which are at various stages of introduction, were developed, 54 VFS's and FS's for medicinal plant raw materials and preparations, 23 new methods of analysis of medicinal plant raw materials and phytopreparations, 6 standards for the control of the quality of medicinal plant raw materials and the stage-by-stage control of the obtained medicinals, 5 procedural recommendations on the efficient use of medicinal plants in individual regions, 5 instructions on the gathering and drying of medicinal plants and 4 procedural recommendations on the cultivation of foreign medicinal plants in the Soviet subtropics were formulated. In all 143 certificates of authorship for the methods of obtaining preparations and biologically active substances from plants were received.

However, not all of the completed works are yet being introduced in health care practice. The specialized councils are still inadequately keeping a record of the introduction of developments in accordance with dissertation research. The institutes, at the base of which the dissertations were completed, do not always check the results of introduction.

The planning of the training of doctors and candidates of pharmaceutical sciences at several higher educational institutions is being carried out without consideration of the need for specialists of the highest skills and consideration of the prospects of scientific research.

The formed practice of selecting dissertation themes is still inadequately oriented toward the performance of research within the statewide programs of scientific and technical progress and the all-union sectorial programs of the problem "Pharmaceutics."

The institutes, at the base of which dissertations are being completed, approve individual themes without a patent information study and without preliminary reviews and check irregularly the progress of the fulfillment of the dissertation work. A number of themes are withdrawn after approval. The time of the completion of dissertations, especially doctoral dissertations, is being dragged out unjustifiably. The reliability of the primary documents of scientific works is being checked inadequately on the part of the management of higher educational institutions and scientific research institutes.

In the future much work has to be done on the analysis of the trends of development of the scientific personnel potential for the problem "Pharmaceutics" for the 12th Five-Year Plan.

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## ORGANIZATION, PLANNING AND COORDINATION

### REGISTRATION OF INTRODUCTION OF SCIENTIFIC ACHIEVEMENTS

Moscow KHOZYAYSTVO I PRAVO in Russian No 3, Mar 85 pp 62-63

[Article by S. Ivanyushin, chief of a sector of the All-Union Scientific Research Institute of Machines for the Production of Synthetic Fibers (VNIIMSV), and Candidate of Technical Sciences A. Vikhrov, senior legal adviser of the All-Union Scientific Research Institute of Machines for the Production of Synthetic Fibers: "The Introduction of New Equipment"]

[Text] The present stage of economic development is forcing us to approach in many respects in a new way the solution of the problems of the acceleration and the increase of the effectiveness of scientific and technical progress. The extensive and rapid introduction in practice of the achievements of science, technology and advanced know-how in recent years has become the most important national economic task.

At present the introduction of new equipment is reflected by enterprises, associations and organizations in special reports on forms which are approved by the USSR Central Statistical Administration. The data of statistical returns make it possible to make an evaluation of the activity of the indicated economic organs in the area of the implementation of scientific and technical achievements.

The Standard Contract for the Transfer by Enterprises and Organizations of Their Own Scientific and Technical Achievements to Other Enterprises and Organizations and for the Provision of Assistance to Them in the Use of Borrowed Advanced Know-How<sup>1</sup> envisages that the assets for the payment of bonuses to the developer are transferred after the introduction of the scientific and technical developments.

Standard Interdepartmental Form No R-10 "Certificate of the Introduction of a Scientific and Technical Measure" and the Concise Instructions on filling it out were approved by the USSR Central Statistical Administration in 1982. This certificate confirms the actual introduction of an innovation. It is drawn up for each measure, which is aimed at the increase of the technical level of production and is connected with the introduction of advanced technology, the mechanization and automation of production processes and the improvement of the use of new types of raw materials and materials. The certificate and its appendices contain data on the economic impact, the

expenditures and other results of introduction over the entire period, during which it ensures an increase of the technical and economic indicators of production.

However, in spite of such a nature, which is universal in content and the coverage of objects of new equipment, the sphere of use of this certificate is limited. According to Paragraph 1 of the Concise Instructions on filling it out, it is intended for the calculation of the indicators of economic efficiency and the filling out of the forms of statistical reporting. Other cases (including for the confirmation of the fact of the introduction of new equipment as the basis of the origination of the right to a material incentive) of the mandatory or optional use of this form of the certificate are not envisaged, since this certificate does not reflect the peculiarities of the introduction of fundamentally new equipment and technology, as well as other innovations, uniting all these objects by the common concept "scientific and technical measure."

In practice the introduction of new equipment, as a rule, is confirmed by certificates in accordance with forms, which have been drawn up by the enterprises, associations and organizations themselves or have been approved by the ministries (departments) and all-union (republic) industrial associations. It is also often registered by certificates of the delivery and acceptance of jobs or other documents, the drawing up and signing of which are not connected with the assimilation of the series or mass production of products or with another practical application of the results of scientific and technical achievements in the national economy. In case of such an approach the issuing of recommendations by the acceptable commission, the production of a prototype and a test batch and the conducting of industrial tests often are groundlessly regarded as introduction.

The lack of uniformity in official registration makes possible the replacement of the introduction of new equipment with the transfer of scientific and technical documents and the receipt of an undeserved material incentive. In accordance with the contracts for the transfer of scientific and technical achievements the assets for the payment of bonuses to the developer are transferred, as a rule, after the completion of the operations, and not after the introduction of their results.

The noted shortcomings are eliminated in part by local regulation. At the All-Union Scientific Research Institute of Machines for the Production of Synthetic Fibers (VNIIMSV) in Chernigov a standard of the enterprise, which regulates the procedure of the introduction of developments of the institute, has been formulated and approved. In conformity with this document there are considered as introduced themes (operations) only those, the results of which have found application in the national economy. For example, a series (batch) of a new type of equipment or a custom-produced item has been manufactured, a new technology has been introduced. The registration of introduction is accomplished by a certificate in accordance with a form, which is appended to the standard and which approximates as much as possible form No R-10.

The intra-institute use of the results of research operations, operations on standardization, patent studies, scientific and technical information and



others, which do not find direct expression in the development of new machines and equipment, is registered by a certificate of the use of completed scientific research, the form of which also approximates the named standard. This makes it possible to keep at the institute an account of all the operations from research to introduction, to identify the operations, the results of which do not find practical application, and to take in good time the appropriate steps on them, to determine more accurately the degree of the proportionate participation of the subdivisions of the institute and specific performers in research and development for stimulation in accordance with the end results.

However, local regulation cannot replace completely enough centralized regulation. In our opinion, for the standardization of the legal registration of the introduction of scientific and technical achievements it seems necessary to approve at the intersectorial level (with the participation of the USSR State Committee for Science and Technology, the USSR Central Statistical Administration and other competent ministries and departments) a common form of the certificate of the introduction of new equipment with the mandatory observance of the following conditions: the firm establishment of an individualized approach to objects of new equipment and the signing of the certificate of introduction by competent representatives of the developer, producer and user.

The introduction of the proposed certificate of introduction would make legally significant and practicable the calculation of the actual indicators of introduction and thereby would place on a real basis the responsibility of the developer and producer for the quality of the new equipment developed by them and the responsibility of the user for the technical level of the issued initial requirements, as well as for the effective and efficient use of the innovation.

The conditions on the production of the developed equipment, its installation, adjustment and operational development at the user's, on the author's supervision of production and introduction, as well as on scientific and technical assistance on the part of the institute are included, as a rule, in the contracts for the performance of scientific research, experimental design and technological operations and for the transfer of scientific and technical achievements, which are concluded by the All-Union Scientific Research Institute of Machines for the Production of Synthetic Fibers with the purchasers of new equipment. As a result the stable tendency for the number of introduced jobs to increase has been observed in recent years. Their proportion in the total number of jobs completed by the institute in 1983-1984 comes to about 70 percent. This is approximately 15 percent greater than for many others. The duration of scientific research and experimental design operations from development to introduction decreased substantially.

Many developments, which were carried out by the institute and were introduced in the national economy with its active participation, are fundamentally new machines, flow lines and units, which conform to the best domestic and world achievements. Among them it is possible to name highly efficient units for the dyeing of polycapromide braid of the rug assortment, which were produced jointly with the Leningrad Machine Building Production Association imeni Karl



Marx and were introduced at a number of enterprises for the production of chemical fibers. The use of these units in many respects made it possible to meet the needs of the population for carpet items. The Selivanovskiy Machine Building Plant (Vladimir Oblast) assimilated the production and starting in 1983 began to produce a machine for the rewinding of scoured silk, which was developed by the institute. The economic impact from the introduction of these machines in the textile industry came to more than 360,000 rubles a year.

At the same time the path from the start of the development of a new machine to its introduction in production in the majority of cases continues to remain lengthy and difficult. The reasons for this are well known: irregularities in deliveries of components and materials for the production of equipment, the untimely preparation of the buyer's production areas for the installation of new equipment, the insufficiently efficient coordination in a number of cases of the actions of the purchasers, performers and users, including in case of the fulfillment of the comprehensive plans of the State Committee for Science and Technology and the Ministry of Machine Building for Light and Food Industry and Household Appliances. The introduction of new equipment, as a rule, is accompanied by the reorganization of production, which requires specific reserves.

Therefore, in our opinion, for the purpose of accelerating scientific and technical progress it would be advisable for the organs of the USSR State Committee for Material and Technical Supply to issue planning certificates for the delivery of products, which are necessary for the development, assimilation and introduction of the achievements of science and technology, on special forms with an indication of the carrying out of shipment first of all (just as for the delivery of products for export, for start-up projects, to the regions of the Far North).

The urgent, difficult and multidimensional problem of the introduction of new equipment requires the purposeful and coordinated activity of enterprises, organizations, associations and organs of economic management.

#### FOOTNOTE

1. Approved by Decree No 530 of the State Committee of the USSR Council of Ministers for Science and Technology of 31 December 1971 (with changes and additions, which were made by Decree No 9 of the USSR State Committee for Science and Technology of 12 January 1978), BYULLETEN' NORMATIVNYKH AKTOV MINISTERSTV I VEDOMSTV SSSR, No 4, 1983, p 18.

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## ORGANIZATION, PLANNING AND COORDINATION

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### ORGANIZATION OF RESEARCH IN PHARMACEUTICS

Moscow FARMATSIYA in Russian Vol 33, No 6, Nov-Dec 84 pp 1-4

[Article by A. I. Tentsova, K. D. Sedova, S. F. Vasil'yeva and S. D. Ivanova, the All-Union Scientific Research Institute of Pharmaceutics (Moscow): "The Principles of the Organization of Scientific Research on the Problem 'Pharmaceutics'"]

[Text] Science under socialism has become one of the leading factors of social progress, since it is influencing more and more perceptibly not only physical production, but also the development of man--the main productive force of society.

The social orientation of science, which has been firmly established in our society, is contributing to the fact that the contribution of Soviet scientists to the accomplishment of the large-scale tasks of the transformation of social production and the improvement of the working and living conditions of the people is constantly increasing.

Under the conditions of socialism not only the goals of science, but also the structure of science as a social institution and the system of its organization and development are changing.

An enormous complex of scientific research, design and planning and technological organizations, as well as pilot works and mighty scientific production associations has been developed in the USSR. Higher educational institutions are an integral part of this complex.

The decree of the CPSU Central Committee and the USSR Council of Ministers "On Increasing the Efficiency of Scientific Research Work at Higher Educational Institutions" is aimed at the increase of the role of science at higher educational institutions in both the socioeconomic and the scientific and technical progress of the country.

Pharmaceutical institutes and faculties should be effective centers of the development of pharmaceutical science, centers of the development of basic and applied scientific research.

In the country 38 pharmaceutical institutes, pharmaceutical faculties of medical institutes and scientific research institutions of the country are conducting scientific research on the problem "Pharmaceutics."

Pharmaceutical higher educational institutions have a great scientific potential. A large number of doctors and candidates of sciences work at them. Thus, in the SFSR on 1 January 1982 75 doctors of sciences and professors and 470 candidates of sciences were taking part in research. Pharmaceutical higher educational institutions are centers of the training of highly skilled personnel--doctors and candidates of sciences. At present with the opening of new pharmaceutical institutes and faculties the scientific research has been brought closer to the regions of the intensive development of natural resources and to the sites of the concentration of productive forces.

It is natural that the very development of the organizational structure of science is raising new problems of its management.

In the decree of the CPSU Central Committee and the USSR Council of Ministers of 22 September 1977 "On Measures on the Further Improvement of Public Health Care" the task was posed to develop and introduce before 1982 a unified comprehensive system of the planning and coordination of scientific research work (NIR) in the area of medicine with the use of computer equipment. "The Statute on the Planning and Coordination of Scientific Research Work in the Area of Medicine," which regulates the functions of the basic units of the organizational system of the planning and coordination of medical scientific research, was approved by the order of the USSR Ministry of Health "On the Improvement of the Methods and Forms of the Organization and Management of Medical Science." The new statute assigns an important place to health care organs in the determination of the social order to medical science. The responsibility of the bureaus of the departments of the USSR Academy of Medical Sciences, the scientific medical councils, the main administrations and administrations of the USSR and union republic ministries of health for the planning of scientific research work and the monitoring of the fulfillment of the plans of subordinate scientific institutions was increased. The role of the main institutions, scientific councils and problem commissions in the coordination of research and in the analysis and expert appraisal of the planned and obtained results was increased.

The all-union five-year plan of the development of medical science, which is made more precise in the republic plans, the plans on problems and the thematic plans of institutions, is the basis of the system of planning. The forms of the plans and reports, as well as the primary information documents--the thematic card and the reporting card, which make it possible to carry out their processing by means of computer, have been standardized. "The Statute on the Main Institution for a Problem of Union Importance of the System of the USSR Ministry of Health," "The Statute on the Problem Commission of the Scientific Council of the USSR Academy of Medical Sciences" and "The List of Scientific Councils and Problem Commissions of the USSR Academy of Medical Sciences" were approved.

At the USSR Academy of Medical Sciences 40 scientific councils have been organized. Problem Commission No 35 "Pharmaceutics" of the USSR Academy of

Medical Sciences, which previously existed independently, at present has been included in Scientific Council No 10 "Pharmacology and Pharmaceutics" of the USSR Academy of Medical Sciences, which unites six problem commissions.

10.01. The Coordination and Scientific Planning of the Development of New Medicinals.

10.02. Pharmacology of the Heart and Vessels.

10.03. Pharmacology of the Nervous System.

10.04. Pharmacology of Metabolism.

10.05. Clinical Pharmacology.

10.06. Pharmaceutics.

Academician of the USSR Academy of Medical Sciences A. V. Val'dman is the chairman of Scientific Council No 10. The main institution of the council is the Scientific Research Institute of Pharmacology of the USSR Academy of Medical Sciences.

The Problem Commission "Pharmaceutics" was approved with a composition of 20 prominent scientists, who are in charge of the basic directions of pharmaceutical science. Corresponding Member of the USSR Academy of Medical Sciences Professor A. I. Tentsova is the chairman, Professor D. A. Murav'yeva, Professor Ye. I. Panchenko and Professor V. P. Chernykh are the deputy chairmen, Candidate of Pharmaceutical Sciences K. D. Sedova is the scientific secretary. The main institute for the problem "Pharmaceutics" is the All-Union Scientific Research Institute of Pharmaceutics of the USSR Ministry of Health.

The Commission "Pharmaceutics" unites four sections, which reflect the basic directions of pharmaceutical science: Section I--"The Study of the Medicinal Flora of the USSR" (Professor N. I. Grinkevich, chairman); Section II--"Pharmaceutical Technology and Biopharmaceutics" (Corresponding Member of the USSR Academy of Medical Sciences Professor A. I. Tentsova, chairman); Section III--"Pharmaceutical Chemistry" (Professor V. G. Belikov, chairman); Section IV--"The Scientific Principles of the Organization and Economics of Pharmaceutics" (Professor Ye. I. Panchenko, chairman).

The Problem Commission "Pharmaceutics" works at the base of the main institute and is a permanent scientific and methods organ, which carries out forecasting, the planning and coordination of scientific research in the basic directions of pharmaceutical science.

The All-Union Scientific Research Institute of Pharmaceutics and the problem commission implement scientific policy in the area of pharmaceutics and bear responsibility to the Presidium of the USSR Academy of Medical Sciences and the Buro of the Scientific Council for the timely and highly efficient elaboration of the treated problem of union importance. For this purpose a comparative analysis of the present state of scientific research on the



problem is made, the development of the basic directions of pharmaceutical science in the USSR for the distant future and by 5-year periods is forecast, the basic tasks are outlined and recommendations on the drawing up of five-year plans of scientific research work are given.

At present in conformity with the statute the problem commission is performing much work on the reviewing of thematic and reporting cards and the plans of doctoral dissertations and is giving an expert appraisal of the urgency and promise of themes, the scientific methods level of research and the novelty and theoretical and practical value of the obtained results. When the expert appraisal shows that the work is insufficiently urgent and promising and is being performed at an inadequately high scientific methods level, the problem commission requires of the performer of the theme the adjustment of the goal and the means of its achievement. If the work does not have novelty (that is, its fulfillment will lead to the obtaining of facts which are known in science), the question of terminating the theme is posed to the management of the subordinate scientific research institution.

The problem commission submits to the Scientific Council a five-year and an annual plan of scientific research on the problem, reports on their fulfillment and suggestions on the annual supplementing and specification of the corresponding sections of the five-year plan of the development of pharmaceutical science; makes an expert appraisal and recommends the most important scientific proposals for inclusion in "The All-Union Long-Range Plan of the Introduction of the Most Important Achievements of Medical Science in Health Care Practice," which are sent to the Main Pharmaceutical Administration of the USSR Ministry of Health and the Scientific Medical Council of the USSR Ministry of Health.

Depending on the value of the obtained research results, introduction can be carried out on four levels: the first level--at one or several health care institutions; the second level--at several health care institutions of a city, oblast or kray; the third level--at the health care institutions of a union republic or several oblasts (krays); the fourth level--at the health care institutions of the entire country.

On the recommendation of the problem commission from the submitted materials there were included in "The All-Union Long-Range Plan of the Introduction of the Most Important Achievements of Medical Science in Health Care Practice for 1981-1985": "The Commercial Operation of the Third Section of the Automated Subsystem of the Planning of the Supply of Medicines to and the Management of the Pharmacy System of the Country (A Subsystem of the Main Pharmaceutical Administration)" and "The Methods of Evaluating the Quality of New Preparations and New Types of Plant Raw Materials, Which Are Authorized for Medical Use."

In connection with the new statute the problem commission is acquainting itself with the state of scientific research and with the training of doctors and candidates of pharmaceutical sciences at subordinate institutes and is hearing at the plenums or buro of the problem commission the reports of the directors of institutions and individual performers on their work.



Thus, a meeting of the problem commission, at which organizational questions were discussed and the plan of basic measures of the Problem Commission "Pharmaceutics" for the 11th Five-Year Plan in light of the decisions of the 26th CPSU Congress was approved, was held in Moscow in June 1981. "The Long-Range Five-Year Plan of the Development of Pharmaceutical Science for the 11th Five-Year Plan" was considered and approved.

In November 1981 in Rostov-on-Don the second plenum of the problem commission considered and approved the All-Union Comprehensive Program of the Development and Introduction of the Automated Subsystem of the Planning of the Supply of Medicines to and the Management of the Pharmacy System of the Country for 1981-1985. The report of the rector of the Perm Pharmaceutical Institute on the performance of scientific research, the introduction of completed works in health care practice and the training of scientists of the highest skill was heard. The doctoral dissertation of Docent A. I. Sichko (Tyumen) was examined.

In May 1982 in Moscow in the buro of the problem commission the questions of the improvement of the methods and forms of the organization and management of medical science were heard and "Recommendations on the Making of an Expert Appraisal of Planned and Completed Scientific Research" were discussed.

In October 1983 in Tbilisi at the third plenum of the problem commission the plan of the preparation of doctoral dissertations on the basic directions of pharmaceutics for the 11th Five-Year Plan was discussed and the reports of the deans of the pharmaceutical faculties of the Tbilisi and Yerevan medical institutes on the performance of scientific research and the introduction of its results in practice and on the fulfillment of the plan of the training of doctors and candidates of pharmaceutical sciences were heard.

The progress of the fulfillment of the doctoral dissertations of Candidate of Pharmaceutical Sciences G. I. Molchanov (Pyatigorsk) and Candidate of Pharmaceutical Sciences G. V. Tsagareishvili (Tbilisi) was examined.

At the same time the All-Union Scientific Conference on the theme "The Development, Study and Comprehensive Use of Medicinal Preparations, Which Are Used for the Treatment of Cardiovascular Diseases" was held jointly with the All-Union Scientific Society of Pharmaceutists.

In May 1983 in Yerevan at the plenum of the problem commission the report on the fulfillment of thematic problem plan of scientific research on the problem during 1982, the progress of the fulfillment of the plan of the sectorial All-Union Comprehensive Program of Scientific Research on Pharmaceutical Analysis, scientific research work and the introduction of the results in health care practice and the training of doctors and candidates of pharmaceutical sciences at the Pharmaceutical Faculty of the Azerbaijan Medical Institute was discussed. The plenum of the All-Union Scientific Society of Pharmaceutists and the problem commission on the theme "Pharmaceutical Terminology" was held there.

In May 1984 in Moscow at the regular plenum of the problem commission the questions of the development of the basic directions of pharmaceutical science

on the problem "Pharmaceutics" of Scientific Council No 10 for Pharmacology and Pharmaceutics of the USSR Academy of Medical Sciences for the 12th Five-Year Plan, the basic principles of the work of the Problem Commission for Pharmaceutics of the Ukrainian SSR during 1981-1983 and the prospects of the development of research in 1984-1985 were discussed.

In June 1984 in the problem commission the progress of the fulfillment of the doctoral dissertation of Docent V. I. Ishchenko, head of the Chair of the Technology of Medicines of the Vitebsk Medical Institute, on the theme "The Biopharmaceutical Study and the Improvement of the Technology of Tablets" was discussed.

Meetings of the sections, at which reports and the plans of scientific research work by directions for the year are examined and suggestions for introduction in health care practice at the union level and the progress of the fulfillment of sectorial comprehensive programs are approved, are held periodically.

Responsible tasks on the improvement of the methods and forms of the organization and management of pharmaceutical science, the monitoring of the fulfillment of the sectorial all-union comprehensive programs and the strengthening of coordination with the republic problem commissions face the problem commission and the main institute.

Especially imposing and difficult tasks are posed for science by the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" (No 814 of 18 August 1983), which is aimed at the increase of the scale of the use in the national economy of science and technology, at the radical improvement of all the work on the acceleration of scientific and technical progress, at the use of goal program planning, at the conducting of research on all-union, republic and sectorial scientific and technical programs, as well as at the intensification of the integration of science and production and the introduction in practice of the achievements of science and advanced know-how.

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7807

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## ORGANIZATION, PLANNING AND COORDINATION

### WORK OF UKRAINIAN BOARD OF SCIENTIFIC ECONOMIC SOCIETY

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 4, Apr 85 pp 67-72

[Article by Deputy Chairman of the Ukrainian SSR State Planning Committee and Chairman of the Ukrainian Republic Board of the Economic Science Society G. Dzis': "The Effect of Combined Efforts"]

[Text] At present, when the economic scientific institutions of the republic are reorganizing their work in conformity with the requirements of the decree of the CPSU Central Committee "On the Increase of the Role of the Institute of Economics of the USSR Academy of Sciences in the Elaboration of the Key Problems of the Economic Theory of Mature Socialism," the intensification of the analysis of the qualitative changes in the productive forces and the means of the improvement of socialist production relations in close connection with the social processes occurring in our society requires the use of additional reserves of the scientific potential of the republic. One such reserve is the Economic Science Society (NEO)--a voluntary mass organization in the system of scientific and technical societies of the USSR, which promotes the development of economic science and the bringing of it nearer to the needs of economic practice.

The organizations of the Ukrainian SSR Scientific Economic Society have already been operating for about 3 years. The tasks facing them on the fulfillment of the mentioned decree of the CPSU Central Committee have been discussed twice: last year at the meeting of the presidium and at the 7th Plenum of the Ukrainian Republic Board of the Economic Science Society. Today it is already possible to speak about several achieved results. New questions, which are connected with the elaboration of specific recommendations, which are aimed at the improvement of the socialist methods of management and for which the results of basic theoretical research are the basis, are being posed in the plans of work of the scientific sections, the oblast boards and the primary organizations. The work is focused, on the one hand, on basic research on those aspects which are predetermined by the decree, with allowance made for the availability in the republic of the necessary scientific reserve and personnel, who are capable of ensuring leading positions, without duplicating other organizations, and, on the other, on the formulation of the most effective economic decisions and the methods and means of their implementation. The specification of the thematic orientation of our work is being accompanied by the improvement of

coordination and the strengthening of the creative contacts between the scientists of academic science, science of higher educational institutions and sectorial science of the Ukraine and other republics.

A number of interesting measures have been implemented by the scientific section "The Economics of Scientific and Technical Progress." With the participation of the primary organization of the Economic Science Society of the Institute of Economics of the Ukrainian SSR Academy of Sciences it is elaborating the problems of the improvement of economic methods of the management of scientific and technical progress. By strengthening contacts with the scientific centers of the Academy of Sciences and the Scientific Council for Problems of Scientific, Technical and Socioeconomic Forecasting attached to the Presidium of the Ukrainian SSR Academy of Sciences and the Ukrainian SSR State Planning Committee, the organizations of the society are making their contribution to the drafting of sections of "The Comprehensive Program of Scientific and Technical Progress and Its Socioeconomic Consequences for 1991-2010 for the Ukrainian SSR."

The sphere of interests of the scientific section "The Economics of the Nonproduction Sphere" is broad. Its subdivisions have actively joined in the study of the laws of the development of the nonproduction sphere and the problems of the standard of living under the conditions of socialism and in the elaboration of the theme "The Improvement of the Territorial Organization of Consumer Goods Production and Services for the Population," as well as the comprehensive program of the development of consumer goods production and services to 2000.

The republic applied science conferences "The Problems of the Improvement of the Economic Mechanism," "The Problems and Means of the Acceleration of Scientific and Technical Progress" and "The Role of Distributive Relations in the Solution of the Economic and Social Problems of Mature Socialist Society," which were held in Kiev last year, and a number of others, during which practical recommendations were elaborated on the basis of a thorough analysis, have contributed to the fulfillment of the decree of the CPSU Central Committee. The members of the Economic Science Society of the Institute of Industrial Economics of the Ukrainian SSR Academy of Sciences are taking part in the elaboration of such important themes as "The Improvement of the Mechanism of the Combination of Sectorial and Territorial Management of Scientific and Technical Progress in the National Economy of the Region," "The Means of Accelerating the Retooling of Industrial Production on the Basis of New Technologies" and others.

However, the potentials of the Economic Science Society are not yet being fully utilized. The great statutory rights and duties of our organization could be realized more completely, if more effective forms of cooperation with academic science, science of higher educational institutions and sectorial science were determined and their scientific potential were merged together.

The economic institutions of the Ukrainian SSR Academy of Sciences and other departments are still giving inadequate assistance to the State Planning Committee and the economic services of the republic in the making of a thorough economic analysis, which is needed for use in the practical work on



the management of the national economy. It is unquestionable that the primary organizations of the Economic Science Society of not only the Institute of Economics of the Ukrainian SSR Academy of Sciences, the Ukrainian SSR Council for the Study of Productive Forces of the Ukrainian SSR Academy of Sciences, the Institute of Industrial Economics of the Ukrainian SSR Academy of Sciences and the Scientific Research Institute of Economics of the Ukrainian SSR State Planning Committee, but also other scientific research institutes should take part in this work. A large role in this work belongs to the scientific sections of the Ukrainian Republic Board and the oblast boards of the Economic Science Society--each according to the sphere of its specialization. The situation, in case of which along with enterprises, which are successfully solving scientific, technical and production problems at the level of the current achievements of science and technology, there also exist such enterprises, at which they are content with what had already long ago become obsolete, should become a subject of the critical analysis of these scientific forces.

Today the question of launching on a broad front work on the improvement of the planning and management of the economy and on the further reform of the economic mechanism, so that it would conform to the level of development of the productive forces, is arising with all urgency. The organization of the Economic Science Society is responding with concrete deeds to this demand, by taking part in the experiment on the broadening of the independence and the responsibility of enterprises and associations for the results of work. Working seminars and conferences have been held: the Cherkassy Oblast Seminar for workers of the oblast planning commission, the oblast finance department, the oblast statistical administration and the oblast office of the All-Union Bank for Financing Capital Investments and the State Bank for the study of the corresponding standard documents; the Kherson Oblast Seminar with workers of the oblast department of the food industry; the Kharkov Oblast Board of the Economic Science Society organized seminars for workers of the economic services of industrial enterprises, managers of the financial and credit system, workers of the oblast planning commission and the oblast department of the food industry; members of the primary organization of the Economic Science Society of the Donetsk Oblast Finance Department took an active part in four seminars.

The analysis of the progress of the economic experiment, which was made by the Dnepropetrovsk Board of the Economic Science Society, made it possible to conclude that the stimuli, which are envisaged by procedural documents, have not yet had an appreciable influence on the results of the work of enterprises of the oblast--the functional services have not reorganized their work; the changeover of enterprises to the new conditions has not provided a stimulus for the further development of cost accounting; a number of procedural documents need serious revision and supplementing. On the basis of such an evaluation a number of additional measures are being implemented.

The decree of the 4th Plenum of its Central Board is a concrete program of the participation of the Economic Science Society in the large-scale economic experiment. The efforts of the scientific economic forces of the society are being concentrated today on the fulfillment of this decree. The first results of the economic experiment at enterprises of the republic Ministry of the Food

Industry were discussed at a round-table meeting which was organized by the journal EKONOMIKA SOVETSKOY UKRAINY jointly with the Ukrainian Republic Board of the Economic Science Society.

Starting in 1985 the group of sectors participating in the experiment has been broadened. On this basis the active members of the Economic Science Society and workers of planning, financial, statistical and other organs and enterprises of the system of state institutions, scientific research and design institutes and higher educational institutions have to be involved even more actively in the formulation of the theoretical principles of the comprehensive improvement of management and planning, their efforts have to be aimed at the elaboration for practice of new organizational structures, forms and methods of management, which promote the interconnection of the development of sectors and economic regions and the strengthening of cost accounting relations.

At present, along with the analysis and substantiation of proposals on individual procedural principles, the task of providing a comprehensive evaluation of the entire set of measures, which are envisaged by the economic experiment, faces the collectives of academic institutes. The primary organizations of the Economic Science Society of the given institutes, as well as of the economic services of ministries and departments and the higher educational institutions of the republics, the scientific sections "The Effectiveness of Capital Investments," "The Saving of Material Resources," "The Economics of the Food Program and the Agroindustrial Complex," "The Economics of Labor and Manpower Resources" and others should be attached to this work. During the all-union and republic reviews of the primary organizations of the Economic Science Society of planning, financial, statistical and other organs of state institutions on their specific contribution to the conducting of the experiment, on the analysis of the achieved results and on the generalization and promotion of the experience, which was obtained during the experiment, the gathering and analysis of such comprehensive evaluations should be stepped up and the most valuable ones of them should be turned over to interested organs.

The work on the improvement of the management of the national economy is proceeding on a broad front. Its effectiveness in many respects will depend on the strengthening of the contacts of the Economic Science Society with economic science and practice.

Such a sphere of economics as the supply of the population with industrial goods and services represents a broad field for the exertion of the efforts and knowledge of the members of the organizations of the Economic Science Society. The situation in it attests to the lack of flexibility in the study and consideration of market conditions and to the insufficiently rapid changeover of works in conformity with the changing demand. The consolidation of the efforts of scientists and specialists of various sectors of the national economy within the scientific sections and commissions of the Economic Science Society, the comprehensive surveys being conducted by them, the thorough discussion of ripe problems and the elaboration of specific proposals are capable of erecting a reliable barrier to the gaining of access

to the shelves by products which are not in demand and, what is the main thing, of affording new opportunities for the production of needed goods.

The participation of the council of the primary organization of the Economic Science Society of the Kharkov Oblast Office of the State Bank in the monitoring of the production of consumer goods and the increase of their quality is specified by an entire list of specific deeds. On the basis of joint decisions with the administration surveys are being conducted for the purpose of ascertaining the possibilities of the expansion and renovation of enterprises, shops and sections for the production of consumer goods; the composition of the commission, which deals with the coordination of the work of the divisions of the office and the institutions of the State Bank, has been approved, the relations with oblast planning and financial organs and the State Inspectorate for the Quality of Goods and Trade have been specified; measures, which are aimed at increasing the quality of goods, are being implemented. The chairman of the council of the primary organization of the Economic Science Society also heads the coordinating commission of the oblast office for the monitoring of the production and delivery of goods. The detailed information, which characterizes the state of affairs in the production of consumer goods, is being systematized with the participation of the primary organization. Owing to this the completeness and thoroughness of the analysis are increasing, which is making it possible to solve more competently and purposefully the problems of meeting the effective demand of the population. State control in matters of lending and settlements is being successfully combined with public control, for which materials of the State Inspectorate for the Quality of Goods and Trade and all the measures of economic and public influence, which make it possible to halt the production of poor quality goods, to prevent their delivery to the trade network and to remove from production unmarketable, obsolete goods, are being used. Reviews for "The Best Institution of the State Bank of Kharkov Oblast in the Organization of the Monitoring of the Production and Delivery to the Trade Network of Consumer Goods" are being held at the institutions of the oblast office of the State Bank. In accordance with their results the collectives, which successfully coped with the set task, are awarded challenge pennants and certificates of the management of the office and monetary prizes from the assets of the primary organization of the Economic Science Society. With the participation of representatives of party and soviet organs and the managers of industrial enterprises conferences, at which questions of the production of goods for the population are discussed, are being held; selection reviews of new types of items recommended for assimilation, in the process of which additional possibilities of increasing the output of high quality goods come to light, are being organized. After such reviews suggestions were made on the additional production of goods in 1983 worth 4.7 million rubles and in 1984 worth 7.2 million rubles. All this contributed to the fulfillment of the plans on the production of consumer goods. Annually the enterprises of Kharkov Oblast assimilate the production of over 500 new types of items. Many of them enjoy a significant demand among consumers. The work experience of the people of Kharkov should be used extensively by all the organizations of the Economic Science Society. This will enable them to actively contribute to the fulfillment of the comprehensive program of the development of consumer goods production and services. For in the end, as was emphasized at the meeting of the Politburo of the CPSU Central Committee on 15 November 1984,



"...all our efforts on the acceleration of the development of the economy... are aimed at having the opportunity to allocate more assets for social needs and to increase more rapidly the standard of living of the population."

The timeliness and soundness of various scientific measures are characteristic of the activity of the primary organizations of the Economic Science Society of the Scientific Research Institute of Economics of the Ukrainian SSR State Planning Committee, the Black Sea Department of the Ukrainian Affiliate of the Scientific Research Institute of Labor and the Institute of Industrial Economics of the Ukrainian SSR Academy of Sciences. It is entirely natural, therefore, that here they are achieving definite gains. And on the contrary, wherever the primary organizations do not know or do not fully fulfill their duties and do not exercise their rights, their influence on the solution of socioeconomic problems has been weakened. In particular, the discussion in the Presidium of the Ukrainian Republic Board of the Economic Science Society of the question "On the Participation of the Economic Community of the Ukrainian Republic Office of the State Bank in the Solution of Socioeconomic Problems in the Countryside" showed this. The use of capital investments, the financing of and extension of credit for the construction of housing and sociocultural facilities would have been carried out better, if the council of the primary organization of the Economic Science Society of the Ukrainian Republic Office of the USSR State Bank had devoted more attention to these questions. This could have appeared both in the provision of assistance to the management of the office of the State Bank in the further development and improvement of checking and auditing work and in the enlistment in this work of a broad group of the economic community of not only the institutions of the State Bank, but also interested ministries, institutions of the All-Union Bank for Financing Capital Investments, the Ukrainian SSR State Planning Committee and others. The trips of workers of the institutions of the State Bank to the sites, the holding of instructional seminars and the elaboration of recommendations are contributing to the more complete, timely and proper financing and monitoring of the progress of construction and the activity of contracting organizations and to the improvement of their credit and settlement service. Such work is now being carried out on the initiative of the administration, while the participation of the primary organization of the Economic Science Society could contribute to the increase of its efficiency. Regardless of the participation of the organization of the Economic Science Society creative brigades are being set up, group seminars are being held and various recommendations are being elaborated. Such shortcomings in the activity of the primary organizations of the Economic Science Society must be resolutely corrected, inertia, formalism and pretentiousness must be eliminated.

The origination of such a mass organization as the Economic Science Society is dictated by the objective requirements of the scientific and technical revolution under the conditions of mature socialism, by the fact the society needs the development of various forms of the creative activity of all strata of the working people. At present the Economic Science Society of the Ukrainian SSR unites 25 oblast boards and the Kiev City Board and about 2,500 primary organizations, which have about 114,000 members. The past years of the existence of the Economic Science Society attest that it is capable of ensuring a multivariant search for the solution of scientific and economic



problems, of carrying out the checking of various suggestions and recommendations, to a certain extent of carrying out the selection and introducing the best of them and of uniting together the forces of academic science, science of higher educational institutions and sectorial science with economic practice.

The experience of the work of the Economic Science Society shows that the activity of its formations contributes to the increase of the quality of theoretical developments and their working up to practical recommendations and proposals for introduction. Among the organizations, which are undoubtedly supporting this work, are the scientific councils of academic institutes and higher educational institutions and the scientific and technical councils of ministries and departments. Hence, the primary organizations of the Economic Science Society have to strengthen the contacts with them.

The Economic Science Society, like other public institutions, is becoming a more and more active participant in the management of scientific and technical progress and the scientific and technical potential of the country, which is called upon to solve the economic problems which face the national economy and to be a connecting link which speeds up the introduction of scientific developments.

The elaboration of various suggestions and recommendations in itself, without the proper organizing work, does not yet imply their automatic implementation. The surveys being conducted with the participation of the Economic Science Society make it possible to come to the conclusion that a significant number of suggestions and recommendations remain, unfortunately, unused. This contradiction is explained not by the abundance of scientific products, but by the inadequate development of the process of their systematic use. In the arsenal of the Economic Science Society there are many different forms and methods, the use of which can actively contribute to the development of this process. Scientific conferences ensure an active search for and the revision of a large number of different suggestions and elaborate collective recommendations. The need for day-to-day informal relations is being met by means of scientific sections, creative brigades and commissions. The discussion of urgent questions of economic practice at the meetings of the councils of the primary organizations, in the presidiums and at the plenums ensures active public control of the introduction of suggestions and recommendations. As a result of scientific missions, production excursions, visits to exhibitions and reports of authors at seminars, schools of advanced know-how and people's universities the need of specialists for scientific knowledge or advanced know-how is being met. The benefit from these measures is unquestionable, their universal and skillful use will make it possible to increase the level of scientific products and their practical use. The primary organizations, scientific sections and boards of the Economic Science Society should improve these forms of work, seek new ones and improve the quality of the measures being implemented.

The effectiveness of scientific developments is connected most closely with the extent to which the requirements of practice are taken into account in scientific research and how promptly they are introduced in production. Consequently, it is a result of the close cooperation of scientific

institutions with economic planning organs, enterprises and associations, as well as of the strengthening of the collaboration of specialists within the scientific sections. "The Suggestions on the Draft of the CPSU Central Committee"--"The Basic Directions of the Reform of the General Educational and Vocational School," which were prepared and sent to directive organs, can serve as an example of such collaboration.

In March of last year the Presidium of the Ukrainian Republic Board of the Economic Science Society approved of the work of the primary organization of the Economic Science Society of the Institute of Economics of the Ukrainian SSR Academy of Sciences on participation in the formulation of "The Method of Determining the Resource Potential of Agricultural Production." This method was a consequence of much work on the discussion of the proposed methods of calculating the resource potential: discussions and scientific conferences were held, the monitoring of the progress of the work was organized, close contact with the scientific section of the Ukrainian Republic Board of the Economic Science Society "The Economics of the Food Program and the Agroindustrial Complex" was established and maintained. As a result, as was noted at the All-Union Economic Conference on Problems of the Agroindustrial Complex (March 1984), a method of calculating the agrarian resource potential, which makes it possible in case of the planning and evaluation of the results of work to take more objectively into account the possibilities of the farms of rayons and oblasts, was suggested to directive organs of the republic. At present the primary organization of the Economic Science Society of the Institute of Economics of the Ukrainian SSR Academy of Sciences jointly with the scientific section of the Ukrainian Republic Board of the Economic Science Society "The Economics of the Food Program and the Agroindustrial Complex" and the Zhitomir Oblast Board of the Economic Science Society is participating in the testing of this method. It is possible to continue the list of such examples. The joint meetings of the primary organizations of the Economic Science Society of planning and other economic organs with the organizations of the Economic Science Society of economic scientific research institutes are aiding the strengthening of cooperation. A subsequent stage of the improvement of this work is the holding of such meetings jointly with the primary organizations of the Economic Science Society of higher educational institutions.

The increase of the efficiency of economic science requires the improvement of the style and methods of scientific work, the establishment of order in the planning, organization and coordination of research, the elimination of parallelism, formalism and the study of minor themes and the improvement of the training of scientists. The level of training of scientists in many respects depends on the ability of the active members of the organizations of the Economic Science Society to implement the joint decree of the All-Union Council of Scientific and Technical Societies and the Collegium of the Higher Certification Commission attached to the USSR Council of Ministers "On the Strengthening of the Contact of Scientific and Technical Societies With the Higher Certification Commission Attached to the USSR Council of Ministers." In conformity with it, it is recommended to the specialized councils for defenses of dissertations and the conferment of academic titles to enlist more extensively in their work the members of scientific and technical societies, and hence of the Economic Science Society (with the right of a deliberative

voice), reflecting their participation in the discussion of dissertations, and to send abstracts of the dissertations being defended to the central boards of the appropriate sectorial societies and to send to the management organs of the Economic Science Society suggestions on the possible introduction of the results of defended dissertations. The organizations of the Economic Science Society should give assistance to scientific institutions, production enterprises and organizations in the choice of a theme of dissertation research, which is aimed at the fulfillment of scientific and technical comprehensive goal programs, and should aid the development of research at enterprises and the introduction of scientific developments in planning and economic practice.

"Clearly, every sector, every enterprise has its own tasks, its own specific nature. But there is a common task, which should permeate in our times the work of all sectors, all enterprises--it is to manage better, to use resources more efficiently, to work more effectively. In other words--*TO MANAGE THE ECONOMY EFFICIENTLY* [in italics]," it was emphasized at the meeting of the Politburo of the CPSU Central Committee on 15 November 1984. The uniting of the efforts of the Economic Science Society and academic science, on the one hand, and of experienced workers, on the other, will contribute to the successful fulfillment of this task.

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## ORGANIZATION, PLANNING AND COORDINATION

### PLENUM OF UKRAINIAN BOARD OF ECONOMIC SCIENCE SOCIETY

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 4, Apr 85 pp 72-73

[Article by L. Omel'chenko, scientific secretary of the Ukrainian Republic Board of the Economic Science Society: "The 7th Plenum of the Ukrainian Republic Board of the Economic Science Society"]

[Text] The 7th Plenum of the Ukrainian Republic Board of the Economic Science Society, which discussed the tasks of the society on the fulfillment of the decree of the CPSU Central Committee "On the Increase of the Role of the Institute of Economics of the USSR Academy of Sciences in the Elaboration of the Key Problems of the Economic Theory of Mature Socialism," was held on 21 December 1984.

In the report of Vice President of the Ukrainian SSR Academy of Sciences and Director of the Institute of Economics of the Ukrainian SSR Academy of Sciences I. I. Lukinov the work of the Institute of Economics and other economic scientific institutions of the Ukrainian SSR Academy of Sciences on the fulfillment of the decree of the CPSU Central Committee was covered in detail and the problems, on which the collectives of scientists are working, were presented.

Chairman of the Ukrainian Republic Board of the Economic Science Society and Deputy Chairman of the Ukrainian SSR State Planning Committee G. V. Dzis' noted that the raising of new questions, which are connected with the elaboration of specific, scientifically sound recommendations which are aimed at the improvement of socialist management, was outlined in the plans of the work of the scientific sections and primary organizations of the Economic Science Society. The main attention is focused, on the one hand, on basic research in those directions, in which the necessary scientific reserve and personnel, who are capable of ensuring leading positions, without duplicating other organizations, are available in the republic, and, on the other, on the formulation of the most effective economic decisions and methods and means of their implementation. The specification of the thematic direction of the work of the organizations of the Economic Science Society is being accompanied by the improvement of coordination and the strengthening of the creative contacts of scientists of academic science, science of higher educational institutions and sectorial science of the Ukraine and other republics.



In the statements of Chairman of the Donetsk Oblast Board of the Economic Science Society and Deputy Director of the Institute of Industrial Economics of the Ukrainian SSR Academy of Sciences N. I. Ivanov and Chairman of the Dnepropetrovsk Oblast Board of the Economic Science Society and Director of the Dnepropetrovsk Department of the Institute of Industrial Economics of the Ukrainian SSR Academy of Sciences V. A. Podsolonko the work of the oblast boards in light of the decree of the CPSU Central Committee was covered in detail. Chairman of the Scientific Section of the Ukrainian Republic Board of the Economic Science Society "The Economics of Scientific and Technical Progress" V. Ya. Mashtabey dwelt on the problems, on which the section is working, and made a number of suggestions on the reorganization of the work of the scientific sections of the society. There were also specific suggestions in the statements of I. I. Iskra and G. M. Dobrov, members of the Presidium of the Ukrainian Republic Board of the Economic Science Society.

A decree of the plenum, in which it was noted that the substantial increase of the practical return of scientific research is the most important tasks of the boards and scientific sections of the primary organizations of the Economic Science Society of the Scientific Research Institute of Economics of the Ukrainian SSR State Planning Committee, the Ukrainian affiliates of the All-Union Scientific Research Institute of Planning and Standards, the Scientific Research Institute of Labor and the Institute of Prices, the Kiev Institute of the National Economy imeni D. S. Korotchenko, other scientific research institutions and higher educational institutions of the economic type, was adopted on the discussed issue. The organizations and active members of the Economic Science Society should take steps so that completed developments would be brought up to a level of readiness, which makes it possible to include them in the plans of introduction of ministries and departments and in the republic State Plan of Economic and Social Development.

Chairman of the Ukrainian Republic Committee of the State Institution Workers Union V. P. Kolomiyets, executives of a number of ministries and departments of the republic and the aktiv of the Economic Science Society took part in the work of the plenum.

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## BUDGET AND FINANCE

### REGULATION OF FINANCING OF SCIENTIFIC, TECHNICAL DEVELOPMENTS

Moscow KHOZYAYSTVO I PRAVO in Russian No 4, Apr 85 pp 56-61

[Article by Candidate of Juridical Sciences B. Mints: "The Financing of Scientific and Technical Developments"]

[Text] 1. In conformity with the policy of the intensification of social production the scale of the use in the national economy of the achievements of science and technology has increased substantially. In the decree of the CPSU Central Committee and the USSR Council of Ministers of 18 August 1983 "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy"<sup>1</sup> the task is posed: to ensure the output by industry in the next few years of products, which conform to the best current models, and the introduction of advanced technological processes for the substantial increase of labor productivity. At the present stage of the development of science and technology real prerequisites are being created for the fulfillment of this task. At the same time it is noted in the decree that the organization of the work on the intensification of production does not yet satisfy the made demands.

The changeover to the intensive means of development presumes that the saturation of the national economy with new equipment is accomplished by the increase of the return from the invested assets, and not due to the increase of the expenditures for these purposes. The maintenance of a rapid pace of the introduction of new equipment requires a precisely adjusted mechanism of financing. Meanwhile the proper procedure of allocating assets for the payment for scientific and technical developments has not yet been established. Various sources of the allocation of assets are also examined in different enforceable enactments without connection with each other. In economic practice it is frequently difficult to determine from what sources the planned operations<sup>2</sup> should be paid for and to ensure payment for already completed developments.

2. The extensive scope of the work on the development of new equipment, the intensification of specialization and cooperation and the complication of economic relations dictated the need for a comprehensive, systems approach to the problems of scientific and technical progress. Such an approach is ensured, in particular, by the use in planning of the goal program method. Thus, scientific and technical programs of four levels: all-union programs,

republic (interrepublic) programs, sectorial (intersectorial) programs and programs of regions and territorial production complexes, will be formulated for the 12th Five-Year Plan. These programs are being formulated in conformity with the adopted Statute on the Procedure of the Formation of All-Union, Republic (Interrepublic), Sectorial (Intersectorial) Scientific and Technical Programs and Scientific and Technical Programs of Regions, Territorial Production Complexes, the Implementation of These Programs and the Monitoring of Their Fulfillment, which was approved by the decree of the USSR State Committee for Science and Technology, the USSR State Planning Committee, the Presidium of the USSR Academy of Sciences, the USSR State Committee for Material and Technical Supply, the USSR State Committee for Construction Affairs, the USSR Ministry of Finance and the USSR Central Statistical Administration of 30 March 1984.<sup>3</sup>

In it the stages of the formulation of the program and the procedure of its inclusion in state and sectorial plans are examined in detail, but a cardinal question: how should the measures envisaged in the program be financed, was left, in essence, open. In the Statute, as, incidentally, in previously adopted enforceable enactments, it is indicated that the main ministry is responsible for the fulfillment of the program as a whole. Consequently, it should have or at least manage the assets which have been allocated for these purposes. However, monetary resources for the payment for scientific and technical developments, as a rule, are not allocated from the state budget to industrial ministries, including the main ministries.<sup>4</sup> These operations are financed by means of the assets which the sectors have, since they have been changed over to the cost accounting system of the organization of operations on the development and assimilation of new equipment.

The changeover to the cost accounting system, in particular, signifies that the sector, which will obtain the corresponding economic equivalent from its use, bears the expenditures on new equipment. But not only the main ministry derives material advantages from technical innovations. To a considerable extent the user sectors, which operate the new equipment, as well as those coperforming sectors, which will produce components for the new equipment (for example, the electrical equipment industry is taking part in the development of a new excavator, preparing for it a new motor, but then is producing this motor in series production), obtain an economic impact.

Thus, for reasons of an economic order the main ministry does not finance the entire set of operations on scientific and technical programs (except sectorial programs), but merely determines jointly with the ministries, which are the coperformers and users, the amounts and sources of financing with allowance made for the estimated cost of the work, on the basis of the monetary resources of the interested sectors. The allocation of assets for the payment for scientific and technical operations is assigned to the sector or sectors, whose enterprises will manufacture in series production new types of products or will use new technological processes and, consequently, will obtain some impact or another (markups for high quality, the decrease of the production cost of industrial products and others). The expenditures on scientific and technical operations in case of the production of machines or complex technological equipment by one sector in accordance with the one-time (single) orders of another are attributed to the purchasing sector.

In the Statute on Scientific and Technical Programs (Paragraph 19) it is stipulated that the financing of operations should, as a rule, be carried out by the ministries (departments) which are responsible for the fulfillment of the program. But the norm is effective only when the legal mechanism ensures its fulfillment. However, in this Statute (just as in other enforceable enactments) such legal means are not named. In particular, it is not indicated how the main ministry should accumulate the monetary assets which are allocated by the interested sectors and how it can dispose of them in case of the subordination of the immediate performers to other ministries. In this connection it is necessary to note that in the Procedural Instructions on the Drafting of State Plans it is specified that in individual cases in accordance with an understanding with the main ministry the scientific research operations, which are fulfilled by coperformers, are financed by the ministries to which the coperforming organizations are subordinate. Actually the mentioned "individual cases" are the daily practice of financial planning.

This practice promotes the introduction in industrial ministries of cost accounting methods of activity and is based as a whole on the sectorial system of the management of the national economy. Such a procedure of financing increases the responsibility of the coperforming ministries for that part of the work, which was assigned to the organizations subordinate to them. Hence follows the conclusion that the further improvement of the procedure of financing scientific and technical programs should be aimed not at the fundamental breakup of established practice, but at the guarantee of the real rights of the main ministries in the establishment of the amounts of assets, which are allocated by interested sectors, in the monitoring of the use of these assets and if necessary in their redistribution subject to the progress and results of the operations.

3. Ministries or enterprises finance scientific and technical operations from the following sources:

- 1) the unified fund for the development of science and technology;
- 2) the assets of capital investments;
- 3) the assets which are taken into account in the production cost of industrial products.

In legal and economic literature in a number of cases bank credit<sup>5</sup> and the assets, which are received by the performers from the clients in accordance with concluded economic contracts for the performance of scientific and technical operations,<sup>6</sup> are included among the sources of financing. We did not do this for the following reasons. The loans through bank credits as borrowed assets are liable to repayment from the source which has been specified or will be specified for the performer. For operations, which are paid for by the client in accordance with the economic contract, the assets from the corresponding source are allocated precisely to him, and not to the performer, while the economic contract merely mediates their transfer to the performer. Let us examine the sources of financing, which we indicated, in their interconnection with each other.



4. The unified fund for the development of science and technology (YeFRNT) is formed in industrial ministries and departments by means of deductions from the planned profit of the enterprises of sector according to a standard which has been established as a percent of the net output and, in individual case, the commodity production.

Moreover, enterprises channel into the unified fund for the development of science and technology a portion of the additional profit (the sum of the wholesale price markups) from the sale of new highly efficient products. The entire set of scientific and technical operations--from basic research to applied development, including the introduction of the results in production--can be financed by means of the unified fund for the development of science and technology. The operations, which follow from scientific and technical programs, and first of all the assignments, which are of union importance, are financed on a priority basis. A reserve of assets, which is formed by means of annual deductions of the ministries from their unified funds for the development of science and technology, is at the disposal of the USSR State Committee for Science and Technology for the additional financing of operations on union scientific and technical programs.

Since the unified fund for the development of science and technology is a sectorial fund, the ministry manages it. The ministry has the right to place a portion of this fund at the disposal of large production and scientific production associations. However, the standards, which specify the amount of assets which are allocated to enterprises, are not stipulated by legislation. The amounts of financing (in all and for each theme) are established for them by the ministry when approving the annual plan of the enterprise on the development of science and technology and the annual estimate of the operations which are paid for from the unified fund for the development of science and technology. When approving these documents, the ministry can decrease the amount of assets for individual themes and remove some operations altogether from financing from the unified fund for the development of science and technology. In disposing of the assets of the unified fund for the development of science and technology, the ministry determines the technical policy in the sector and concentrates monetary assets on the main directions of science and technology, which, undoubtedly, is necessary for the assurance of the centralized management of the national economy.

At the same time in economic practice questions connected with the use of the unified fund for the development of science and technology are arising more and more often: To whom should the assets of this fund be allocated--should they be allocated to the performer, who is responsible for the fulfillment of the assignment (theme) as a whole, or directly to the coperformers, to whom a specific portion of the work has been assigned?

The financing of operations on scientific and technical programs can on certain terms be carried out through the coperforming sectors. However, it would be incorrect to extend the practice of financial planning of the intersectorial level to the relations between the immediate participants in development. The relations between the "upper tiers" of management (ministries), on the one hand, and between the participants in development, on the other, are not identical. In the former case it is a question of

organizational administrative relations (the planning and financing of operations), while in the latter it is a question of economic property relations. The duty and right to demand payment for performed work are of a property nature and should be based on contractual or other liability relations of the parties.

Meanwhile the practice of a number of ministries, in which the system of supply orders has been adopted, attests that the client (the corresponding subdivision of a ministry or the industrial association) pays the responsible performer only for the operations, which are performed by itself or by its coperformers from other ministries in accordance with the concluded contracts. The expenses are reimbursed to the coperformers of one's own sector, including the enterprises which are the users of the development and whose duty is the introduction of its results in production, by their superior organizations. Thus, the payment for the work of coperformers is separated from the liability relations of the parties and is made as if outside these relations. As a result the importance of the supply order, which is called upon to perform the role of the economic contract, decreases substantially, since one organization commissions and accepts the work (the party of the liability), while the other pays for it.

The following suggestions follow from the foregoing.

First. The subdivisions of the ministry cannot be holders of the assets of the unified fund for the development of science and technology with respect to the operations of coperformers, since they are not capable of encompassing all their essential aspects. The responsible performer, to whom monetary resources should be allocated for the fulfillment of the assignment (theme) as a whole with the right to dispose of them and to make settlements with the coperformers with allowance made for the progress of development, should always act as a client for the coperformer.

Second. Either independent scientific and technical organizations of the sector or production associations and enterprises, which have within them scientific and technical subdivisions, can be the responsible performers of a development. Precisely these organizations have, as a rule, an adequate scientific potential in order to carry out scientific and technical operations, to be responsible for the accomplishment of the assignment (theme) assigned to them as a whole and to interact with the coperformers, who are engaged in the fulfillment of the part of the development, which has been entrusted to them. The enterprises, which do not have such a potential, cannot be responsible performers with respect to the assignments which are financed from the unified fund for the development of science and technology. The reimbursement of the expenditures from the unified fund for the development of science and technology, which are connected with the introduction of major scientific and technical developments, should be made through the scientific and technical organizations of the sector.

Third. In Decree No 695 of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979 it is stipulated (Paragraph 51 "a") that the changeover of enterprises and scientific and technical organizations to the cost accounting system of the organization of operations on the development,

assimilation and introduction of new equipment is carried out on the basis of supply orders (contracts). It would be incorrect, in our opinion, to understand the mentioned norm of law in the sense that in one sector or another of industry the carrying out of scientific and technical developments, which are financed from the unified fund for the development of science and technology, should be registered only by supply orders (for example, in the Ministry of the Electrical Equipment Industry) or only by the conclusion of economic contracts (in the Ministry of Heavy and Transport Machine Building). The use of both of the indicated methods of registering the liability relations of the parties is the optimum variant.

Here the contractual method should, in our opinion, be used in those instances when the enterprise, in whose production the scientific and technical development will be used, should act as the responsible performer of the assignment (theme). The assets, which are necessary for the performance of the job as a whole and from which it will pay on a contractual basis for that part of the work, which was performed not by its scientific and technical subdivisions, but was entrusted to coperformers, should be allocated to such an enterprise from the unified fund for the development of science and technology of the sector. There is no need here to use the system of supply orders, since the enterprise is simultaneously the performer and user of the development, while the themes of the work and the amount of resources being allocated are specified in the annual plan of the enterprise, which was approved by the ministry.

In those instances when a scientific and technical organization of the sector is the responsible performer of the assignment (theme), it is advisable to use the system of supply orders. The client (the subdivision of the ministry) pays the responsible performer for the entire amount of work, which was envisaged by the supply order, including for that part which was performed by coperformers.

The expenses, which are connected with the performance by it of its duties, which are stipulated in the supply order, on the introduction of the results of the development in production, should be reimbursed to the user enterprise (the coperformer) in the same manner (that is, through the responsible performer). The real participation of the scientific and technical organizations of the sector in the introduction of their developments in production would be ensured in precisely this way.

5. In the state plans of economic and social development in the section on the planning of capital construction the limits of capital investments are specified by ministries and departments, while in the sectorial plans they are specified respectively by enterprises and construction projects. The scientific and technical operations on the designing of machines and complex technological equipment, which is produced in accordance with one-time (single) orders, are compensated for by means of the assets which are envisaged in the estimates for capital construction. In accordance with such orders the enterprises of machine building produce a significant amount of the most complex equipment for the blast furnace process, rolling, steel smelting and wire drawing, boilers, turbines and others. The economic relations, which are forming here, are very complex, since they should be linked with the



entire set of relations in the sphere of design and construction operations. Moreover, the producers and clients are subordinate, as a rule, to different ministries. The corresponding demands on the legal regulation of the relations in question should also be made with allowance made for all these circumstances.

On the practical level these relations are regulated by the enforceable enactment on the procedure of allocating assets for operations on the designing of machines and complex technological equipment, which was approved by the USSR State Planning Committee, the USSR State Committee for Construction Affairs, the USSR State Committee for Science and Technology and the USSR Bank for Financing Capital Investments on 18 December 1981, as well as in Letter No 228 of the USSR Bank for Financing Capital Investments of 27 August 1982. In these legal statutes the procedure of allocating assets for the payment for the operations in question is made dependent on a number of circumstances: a) the length of the cycle of designing and production; b) whether the expenses for designing are included in the cost of the equipment; c) the stage of designing (the detail design, working drawings).

In the letter of the USSR Bank for Financing Capital Investments an attempt was made to envisage all the possible versions of the interrelations of the parties with allowance made for the above-named circumstances, which were taken in various combinations. Thus, by means of the assets of capital investments, which have been allocated to the client in accordance with the annual plan of capital construction, designing is paid for only in case of a long cycle of the production of equipment--1 year and more. Here the working drawings are to be paid for only when the expenses for contract and detail designing are not included in the price of the equipment. The contract design is paid for in accordance with the contract for its elaboration (prior to the delivery of the equipment). The working drawings are to be paid for not separately, but together with the equipment which has been produced and turned over to the client, that is, in conformity with the concluded delivery contract.

The regulations of the financing of expenditures on the designing of equipment are aimed at preventing what are called "worthless" operations, when the contract designs and working drawings for various kinds of reasons (which for the most part do not depend on the producer) are not embodied in machines and units. The problem of "worthless" operations actually does exist, but it is necessary to overcome it by more efficient planning, including financial planning, and not by the casuistic regulation of operations on the designing of new equipment. As is known, the enforceable enactment cannot encompass all the diversity of economic life, but this does not mean that everything that is not envisaged in it should be prohibited. On this level Clarification No 27 17 of the USSR Bank for Financing Capital Investments of 20 October 1982, which was given to its Sverdlovsk Oblast Office, is characteristic. It is stated in it: "In case of the drawing up of documents by design and other organizations, which are on the balance sheet of producer plants, separate payment for the contract design should not be made, while the cost of drawing up the documents is reimbursed to the producer plants together with the cost of the produced equipment." Such an explanation, the



untenability of which is obvious, was given, apparently, only because in the above-named statutes there is no mention of such a situation.

The implementation by the organs of the Bank for Financing Capital Investments of their control functions is necessary, but in the mechanism of legal regulation there should also be means which ensure the protection of the legal interests of the enterprises, which develop and use new equipment. The parties of the contract for designing, especially the producers, are in this respect in an unfavorable position, since the procedure of reviewing their disputes with the institutions of the Bank for Financing Capital Investments has not been established, while they cannot curtail (halt) one job or another due to the lack of assets, since it is envisaged in the plan.

6. The assets, which are taken into account in the production cost of industrial products, are also a source of financing. The expenditures on scientific and technical operations, which either should be financing from other sources on the basis of the nature of the work or cannot be financed from the assets of the unified fund for the development of science and technology due to the shortage of financial resources, are attributed directly to the product cost. In the former case the expenses, which are connected with individual operations on the improvement or modernization of the technology and organization of production, are attributed to the production cost.

The possibility of using assets from this source is important in the daily scientific and technical activity of the enterprise. The unified fund for the development of science and technology is a sectorial fund, the ministry manages it. As for the production development fund, which is under the jurisdiction of the enterprise, mainly operations on the plans of retooling, including the introduction of new equipment, but not scientific developments proper, are financed from this fund. Thus, the production cost of industrial products is still the only source, the assets of which the enterprise can dispose of independently and efficiently for the conducting of scientific and technical development. The need for this source is dictated by the increasing dynamism of production.

#### FOOTNOTES

1. See SP SSSR, No 24, 1983. Hereinafter the decree of 18 August 1983.
2. See, for example, Case No 8-440-1984 of the state board of arbitration of Moscow on the collection of 36,433 rubles, which constitute the cost of the operations, which were completed, but were not paid for by the client due to the lack of assets.
3. Hereinafter the Statute on Scientific and Technical Programs.
4. See "Metodicheskiye ukazaniya k razrabotke gosudarstvennykh planov ekonomicheskogo i sotsial'nogo razvitiya SSSR (utverzhdeny postanovleniyem Gosplanom SSSR ot 31 marta 1980 goda No 63)" [The Procedural Instructions on the Drafting of State Plans of USSR Economic and Social Development

(Approved by Decree No 63 of the USSR State Planning Committee of 31 March 1980), Moscow, "Ekonomika", 1980, p 31. Hereinafter the Procedural Instructions on the Drafting of State Plans.

5. See, for example, M. P. Ring, "Khozraschetnaya sistema sozdaniya i vnedreniya novoy tekhniki. Pravovyye problemy" [The Cost Accounting System of the Development and Introduction of New Equipment. Legal Problems], Moscow, "Nauka", 1982, pp 276-278.
6. See, for example, G. A. Lakhtin, "Ekonomika nauchnogo uchrezhdeniya" [The Economics of the Scientific Institution], Moscow, "Ekonomika", 1979, p 135.

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7807

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## BUDGET AND FINANCE

### PROBLEMS OF STIMULATING SCIENTIFIC, TECHNICAL DEVELOPMENT

Moscow FINANSY SSSR in Russian No 4, Apr 85 pp 39-44

[Article by Doctor of Economic Sciences Professor M. V. Romanovskiy, Leningrad Institute of Finance Economics: "Financial Problems of the Economic Stimulation of the Development of Science and Technology"]

[Text] In the comprehensive program of the improvement of the economic mechanism significant attention is devoted to the improvement of the economic stimulation of scientific and technical progress (NTP). A number of specific economic and moral measures in this area are already being implemented. It is envisaged to extend the cost accounting system of the organization of operations on the development, assimilation and introduction of new equipment to a number of sectors of the national economy--construction, transportation, communications, geology, agriculture and material and technical supply. The extension of this system to the majority of sectors of physical production requires the solution of a number of difficult methodological and procedural problems and first of all in the area of the planning and accounting of the economic impact, as well as the financing of the development of science and technology. Thus, up to now there is no unified statute on the accounting and the procedure of the reflection in reporting, first of all in financial indicators, of the economic impact. In our opinion, it is necessary that every developing organization and introducing enterprise would keep a below-the-line record of the amounts of the confirmed guaranteed economic impact with its subsequently writing off from the account relating to the property of others in case of the introduction of a development and the obtaining of the actual economic impact. In this case it is possible not to confine the formation of the incentive funds for new equipment from the actual impact with respect to the first source (the decrease of the production cost) to the framework of a separate sector, that is, it is possible to increase the possibilities of the intersectorial distribution of the profit.

In this article we will example in more detail one of the most important components of the economic mechanism of the management of the development of science and technology--the system of financing. Very significant amounts are allocated annually for these purposes; according to the plan for 1985 the amount of financing of scientific research and experimental design work came to more than 27.5 billion rubles. The efficient use of these assets is the most important factor of the intensification of all social production.



In economic literature the role of finance in the management of the development of science and technology is often reduced to the assurance of the stable receipt of assets. The term financing is interpreted as a form of redistribution, a financial category, a method of management, which takes the form of the transfer of monetary assets and the right to use them, a system of forms and methods of the use of financial resources.

It is possible to define the sectorial system of the financing of the development of science and technology, in our opinion, as a specific form of the management of the process of the development, assimilation and introduction of new equipment on the basis of specific regulations and legal norms of the formation, distribution and granting of monetary assets for the assurance of the fulfillment of the plan of the development of science and technology.

The financing of the development of science and technology should be of "an active nature" and should purposefully influence the shortening of the time of the introduction of new equipment in social production and the increase of the cost effectiveness. This is achieved by the creation of a special system of funds of the financing and economic stimulation of scientific and technical development, which includes the unified fund for the development of science and technology (the unified fund), the production development fund and a special system of economic stimulation funds of scientific research organizations (NIO's) and additional deductions for the material incentive funds of production associations (PO's). This system should be closely connected with the price and credit methods of the reimbursement of the additional production costs in case of the assimilation and introduction of new equipment.

The social purpose of this system of funds appears in the specific functions of: 1) the financing of the preproduction stage of the reproduction process, 2) the compensation of the increased expenditures of the first years of the assimilation and introduction of new equipment, 3) the rewarding of collectives and individual workers with bonuses subject to the achieved end result and the actual economic impact for the national economy.

In the sectors of industry, which have been converted to the cost accounting system of the organization of work on new equipment, the unified fund, as well as budget allocations and credits of the USSR State Bank are becoming the basic source of financing.

The formation of the unified fund far from solved all the problems of the development of science and technology, and in a number of cases, moreover, also created additional ones. Let us note several of them. The unified fund for enterprises is first of all a subsidy fund, the obtaining of assets from it is not connected with the obtaining of an additional wage fund (according to separate standards). It is in practice not connected with the results of their activity, it is less profitable for enterprises to perform operations at its expense than to develop new equipment at one-time prices. The deductions for the unified fund at the expense of the profit place sectorial ministries under difficult conditions in case of the nonfulfillment of the plan of the profit, a standard base of its planning and distribution is lacking (the norms

are established from the base by the method of extrapolation). In recent years the functions of the unified fund have been broadened significantly. It is becoming the source of payments of one-time bonuses, the payment of interest for credit on individual types of loans and so on, which limits to a certain degree the fulfillment of its basic function.

It is possible to distinguish the following problems, which it is necessary to solve for increasing the influence of the entire mechanism of the formation and use of this fund: how to calculate the standard of deductions of assets for the unified fund; what indicator of activity should be chosen as the base for the determination of the standards of deductions; by means of what assets the unified fund should be formed and how to distribute them among all-union industrial associations and production associations; how to strengthen the cost accounting connection of the unified fund with the end results of the activity of enterprises (associations); how to give the entire process of financing from the unified fund a more active stimulating nature.

Let us attempt to briefly answer the posed questions. During the year of the changeover the unified fund is calculated by adding up the resources previously available in the sector for the financing of scientific research work, experimental design development and the preparation of production (the deductions for scientific research work from the cost of the commodity production, the assets of the state budget for the financing of scientific research work and the fund for the assimilation of new equipment) and subsequently in proportion to the increase of the production volume, according to the obtained standard.

However, the connection between the expenditures on scientific research work and experimental design development cannot be linearly dependent on the value of the indicator of the result of production. During the research conducted by us it was established that in machine building sectors the increase of the production volume determines only 43.8 percent of the amount of the expenditures on scientific research and experimental design work and the preparation of production.

The extrapolation to subsequent periods of the base amount of the unified fund, which was formed during the year of the changeover, in proportion to the increase of the production volume can lead to disproportions in the use of the scientific and technical potential of individual sectors and to the significant decrease of the effectiveness of the use of the assets for the financing of the development of science and technology. Whereas during the 9th and 10th Five-Year Plans in case of the changeover of each sectorial ministry to the new system of planning, financing and economic stimulation a stable standard (on the basis of the base ratios) to the volume of commodity (sold) production was determined, for the 11th Five-Year Plan standards, which were differentiated by years of the five-year plan, began to be elaborated. For 1985 their value ranges from 0.091 (the Ministry of the Meat and Dairy Industry) to 5.183 (the Ministry of Instrument Making, Automation Equipment and Control Systems) of the commodity production and from 5.183 (the Ministry of Heavy and Transport Machine Building) to 9.526 (the Ministry of Power Machine Building) according to the standard net output.

Here a decrease of the standard by individual years of the five-year plan is envisaged for practically all ministries. For example, for the Ministry of Instrument Making, Automation Equipment and Control Systems--from 6.1 percent in 1981 to 5.2 percent in 1985, for the Ministry of the Electrical Equipment Industry--from 9.7 to 9.2 percent, for the Ministry of Power Machine Building--from 3.9 to 3.5 percent. The growth rate of the expenditures from the unified fund will be less than the growth rate of the production volumes, which hardly conforms to the tasks of the development of science and technology in these key sectors of machine building. Consequently, the financial backing of such expenditures is becoming more exacting during the 11th Five-Year Plan as compared with the preceding ones.

The amount of the sectorial unified fund should be determined not by some one indicator of the production volume, but by a set of indicators (factors), which characterize most completely the activity of the sector and are calculated according to the total of the preproduction expenditures on scientific research work, experimental design development and the preparation of production. These indicators should determine the technical level of products and production with respect to all its functional components and include specific and generalizing indicators of the efficiency of the activity of economic systems.

For the determination of the amount of the unified fund on the basis of the analysis of the statistical data for 7 years for one of the all-union industrial associations of the Ministry of Machine Building for Light and Food Industry and Household Appliances we developed a correlation-regression model of the determination of the level of expenditures on scientific research work and experimental design development and the preparation of production (Y) subject to seven factors (indicators) which were chosen and substantiated by a high statistical dependence, which is connected with the results of the introduction of scientific developments (the multiple correlation coefficient is  $R=0.943$ ).

The obtained model has the form:  $Y=73.5+11.08x_1+5.1x_2-25.3x_3+0.012x_{10}+55.9x_{11}-22.4x_{15}+0.013x_{16}$  and shows that additional expenditures on scientific research work and experimental design development in the amount of 11,080 rubles are required for the increase of the share of products of the highest quality category ( $x_1$ ). Accordingly  $x_2$  shows the amount of investments for each percent of the updating of products,  $x_{10}$ --per ruble of increase of labor productivity,  $x_{11}$ --for the output-capital ratio,  $x_{16}$ --for the production volume,  $x_6$  reflects the dependence of the expenditures on the level of the technical equipment of labor,  $x_{15}$  reflects their dependence on the level of the profitability.

Such an approach makes it possible to determine the amount of the unified fund as a whole for the ministry and on its basis to establish for each year of the five-year plan a dynamic standard of deductions, which is the same for all enterprises and production associations of the sector.

The calculation of the dynamic standard requires the settlement of the question of the base of its computation, which should have a high statistical stability with respect to the amount of the unified fund. From the indicators



proposed in economic literature as the base for the calculation of the standard of the deductions of assets for the unified fund the indicators of the profit and the standard net output have the least statistical stability, while the volume of the gross, sold and commodity production and the production cost have the greatest. We believe that the last one is more preferable as the base for the calculation of the standard of deductions for the unified fund. This is connected with the fact that it, first, has a greater statistical stability, second, is becoming during the 11th Five-Year Plan a planned indicator and, third, the inclusion in the production cost of the deductions for the formation of the unified fund conforms to a greater degree to the economic nature of the expenditures on scientific research work and experimental design development as a preproduction stage of the entire reproduction process. As to the expenditures on the preparation of production, the necessity of ascribing them to the production costs is recognized by the majority of economists.

Thus, the proposed approach to the planning of the assets of the unified fund makes it possible on the basis of the correlation-regression model to calculate its amount on the basis of the assignments on the increase of the indicators, which the expenditures from this fund for each year of the five-year plan influence. By ascribing this amount to the production cost it is possible to determine the dynamic standard of the deductions for all the enterprises (production associations) which belong to the sectorial ministry and will channel the assets into the unified fund in proportion to their amount of expenditures on production. They will obtain assets from it already depending on their own "contribution" to the fulfillment of the established plan indicators of the sector. Such a mechanism of the formation and use of the unified fund corresponds to a greater degree to the principles of cost accounting financing.

The question of strengthening the interconnection of the unified fund with the results of the activity of enterprises and associations, as before, remains problematic. The analysis of the practice of its formation showed that the amounts of assets, which are channeled by individual all-union industrial associations and production associations into the unified fund, are determined not subject to their real need, but most often by the stability of their financial situation, as a result of which only 80 percent of the enterprises and associations of the studied ministries made deductions of assets to this fund. While changing the planned amounts of deductions to the unified fund for individual enterprises, even in case of the significant nonfulfillment of the plan of the profit with respect to many of them, the ministries do not allow substantial losses in the centralized assets of the fund. This weakens the connection of the latter with the results of the activity of individual associations and the sector as a whole. Thus, for the five studied sectorial ministries, as a result of the nonfulfillment of the plan of the profit in 1982 by 147 million rubles, the amount of the decrease of the unified fund on the basis of the initial amount of the profit, which was channeled into it, should have come to 30 million rubles, but in fact was equal to 10.5 million rubles.

The aspiration to retain in the ministries the initially planned amount of assets of the unified fund objectively stems from the need for the complete

backing with financing of the plan of the development of science and technology regardless of the fulfillment of the plan of the profit by individual enterprises. Therefore, the cost accounting dependence of the deductions of assets for the unified fund on the actual profit was greatly weakened, while the problem of its connection with the profit, which is obtained as a result of the introduction of scientific and technical developments, was not solved at all prior to 1979. The strengthening of the connection of the unified fund with the results of the activity of the sector only by channeling into it a portion of the incentive markups on the wholesale prices for efficiency and the State Emblem of Quality does not solve the problem completely. Calculations (on the basis of the actual data on the obtained amounts of these markups for 1983) show that the amount of assets of the unified fund due to the inclusion in it of the incentive markups on wholesale prices increases by only 3.3 percent (the calculation was made for 28 sectorial ministries) and ranges for individual ministries from 0.06 percent (the Ministry of the Petroleum Industry) to 5.7 percent (the Ministry of Chemical and Petroleum Machine Building),<sup>2</sup> which it is hardly possible to recognize as significant.

For the purpose of strengthening the cost accounting connection of the unified fund with the results of the activity of production associations (enterprises), all-union industrial associations and ministries as a whole it is possible to use a fundamentally new model of its formation on the basis of the use of deductions from the production cost and a portion of the profit, which is obtained as a result of the introduction of scientific and technical developments.

We propose the following model of the formation of the unified fund of the sector ( $U_f$ ):

$$U_f = \sum_{j=1}^m N_i C_{ji} + \left[ \sum \eta \Delta P_j + AP + RE \right],$$

centralized  
part

left at the disposal of  
production associations  
for financing resourceful  
developments

where  $N$  is the dynamic standard of deductions for the unified fund from the production cost for year  $i$  of the five-year plan;

$C$  is the production cost of the commodity production of production association  $j$  during year  $i$ ;

$\eta$  is the standard of deductions from the profit which was obtained from the decrease of the production cost as a result of the introduced developments (the amount is established by the superior organization subject to the need for the financing of resourceful developments);

$\Delta P$  is the profit from the decrease of the production cost of the commodity production as a result of the introduced developments less the portion which has been channeled into the incentive funds;

AP is the portion of the profit, which is channeled into the unified fund from the additional profit from the incentive markups on the wholesale price (in accordance with the prevailing statute);

RE is the receipts from the sale of experimental models.

The formation of the unified fund in accordance with the proposed model would make it possible to strengthen its connection with the cost accounting results of activity. The experimental calculations of the amount of the unified fund in the Ministry of Heavy and Transport Machine Building show that in this case the share of the profit, which was obtained by means of intensive factors of its increase and is channeled into the unified fund, increases from 4 to 20 percent and its second part would ensure the financing of resourceful developments which are being carried out directly by enterprises (associations).

The creation of the unified fund does not solve all the problems which are connected with the introduction and extensive dissemination of advanced technology. In particular, the most important stage of developments--their introduction--is being inadequately stimulated, especially in those instances when it is accompanied by the making of associated capital investments.

The tendency for the financing of expenditures on the preparation of production to decrease is observed in practically all the analyzed ministries. Their share for 28 sectorial ministries in 1982 came to 17 percent and ranged from 0.1 percent (the Ministry of Light Industry) to 43 percent (the Ministry of Chemical and Petroleum Machine Building). In order to avoid this, some economists propose to develop rigid standards of the regulation of expenditures from the unified fund on individual directions. It seems advisable to use such approximate standards only for long-range planning at the level of the sector as whole, in the context of annual planning they should be of an indicative nature.

Dissociation in the planning of the assets of the unified fund and the production development fund and the lack of the necessary control often lead to irregularities in the use of the assets of the unified fund. The outlays made from the unified fund act, as a rule, as primary outlays with respect to the assets of the development fund and to a significant extent influence its amount. Therefore, the closer coordination of the planning of these funds by the finding of standard statistical dependences of their amount is necessary. Such an approach could improve the balance of assets and promote the optimization of the financial resources which are allocated for different stages of the "science--technology--production" cycle. For this purpose the sources of assets for the financing of capital outlays with their specific backing with all types of resources should be reflected in the orders for the performance of scientific research work. In practice this requirement is often not fulfilled.

Credits of the USSR State Bank play a great role in the economic stimulation of the development, assimilation and introduction of new equipment. The orientation toward cost accounting methods of work on new equipment in the



sectors of industry made it possible to broaden significantly the area of use of credit in the sphere of sectorial science.

The further development of lending in this sphere is occurring both in the form of the use of credit as an additional source for covering the expenditures on the development and assimilation of new products and in the form of a special-purpose source which is envisaged in the plans of the financing of expenditures on the development of science and technology. However, the amount of the credits is extremely negligible.

At present the changeover of sectorial scientific and technical organizations to the system of payment for work, which has been completely finished and accepted by the client, is being carried out. The changeover should increase the influence of finance and credit on the acceleration of the completion of developments and should overcome the noted undesirable tendency for the growth rate of unfinished scientific developments to lead the growth rate of the amount of completed scientific research work. The changeover of sectorial institutes to settlements for completely finished jobs requires the settlement of a number of difficult procedural questions, particularly the question of the planning of the amounts of scientific products, which are turned over and sold, the provision of sectorial institutes with internal working capital, the planning and organization of the extension of credit for expenditures.

An important feature of the system is the fact that the expenditures on the performance of operations, including those fulfilled by coperformers, are taken into account in the balance sheet of the organization prior to their full completion and payment for them. Accordingly, the operations, which have been completed by coperforming organizations, are included in the report of the client only on the condition of their total completion, their acceptance in accordance with established procedure and payment for them. Here the client puts on his own balance sheet the cost of the work to be introduced, which has been completely finished and accepted and for which the performer has been paid, and takes it into account prior to the moment of introduction. The writing off of the expenditures on introduced scientific research, planning and design and technological work from the balance sheet of the client is carried out on the basis of certificates of introduction.

The performing organizations put on their own below-the-line record the work to be introduced, which has been completely finished and has been accepted and paid for by the client. It is advisable to extend such a procedure to not only sectorial, but also other scientific organizations, which will make it possible to obtain on the scale of the entire national economy a realistic (cost) picture of the state of the introduction of scientific developments and the efficiency of the use of the financial resources which have been allocated for the financing of scientific research work.

The changeover of sectorial scientific organizations to the system of payment for operations, which have been completely finished and accepted by the clients, accomplishes the important national economic task of quickening the time of the completion of developments. The financing of scientific research work acquires a truly more active, stimulating nature and promotes the

increase of the influence of finance on the intensification of scientific development.

The need for the introduction of cost accounting relations in the sphere of sectorial science and for the increase of the influence of credit on the shortening of the time of development requires the solution of the problem of providing scientific research organizations with internal working capital. At present only about 5 percent of their need is covered by internal working capital.

An experiment on the provision of scientific organizations with internal working capital has been conducted in the electrical equipment industry since 1979 (in the Ministry of Heavy and Transport Machine Building since 1983), a method of its standardization has been developed. The obtained results make it possible to infer its positive influence on the shortening of the cycle of scientific research and the decrease of the amount of unfinished work. However, the prevailing procedure of providing scientific research organizations with internal working capital envisages the calculation of a standard for practically all developments, allotting to the share of credit about 4 percent in the meeting of their need for working capital.

On the basis of the analysis made by us of the distribution of working capital in scientific research organizations and the duration of developments it is possible to conclude that it is advisable to cover by internal working capital design and technological developments with a duration of up to 1.5 years with a large portion of recurrent operations, which makes it possible to determine more precisely with respect to them the coefficient of the increase of expenditures and to calculate the standard of unfinished production. For the majority of sectorial scientific organizations the proportion of such developments comes to no more than 30 percent of the amount of expenditures, which makes it possible to ensure their meeting by internal working capital over 4 years by means of assets of the unified fund and the development fund of the organization without the attraction of budget assets. Such a solution of the problem creates for the organization additional stimuli for the quickest completion of these operations. It is advisable to extend credit for developments with a duration of over 1.5 years (in case of the changeover to payment for completely finished operations) in accordance with the procedure established by Letter No 312 of the State Bank Board of 27 October 1980.

In recent times the stimulating importance of incentive markups on wholesale prices has increased sharply. At the same time the sharp increase of the amount of the incentive markups, which are realized in the form of an additional profit, is leading to a lack of balance of the plans of the production cost and the profit in the user sectors, is creating the steady tendency for the prices for equipment, which are not taken into account in the plan, to increase and is separating the wholesale prices from the socially necessary expenditures (K. Marx stressed that "the use value of a machine, and its replacement of human labor is also its use value, does not determine its value, the latter is determined by the labor which is necessary for its own production").<sup>3</sup>

A significant portion of the sectorial ministries are fulfilling the plan of the profit only with allowance made for the additional profit from incentive markups. Therefore, it is advisable to take the amount of the incentive markups into account in the total amount of the planned profit and to single it out in the financial plans by a separate line. It is also desirable to conduct the following experiment. Not to increase the wholesale prices for machine building products by the incentive markups, but to use them only as an estimate for the determination of the growth rate of the production volume and labor productivity, that is, to introduce a system of two prices--for settlement with the users at wholesale prices without incentive markups, which will have a positive influence on the decrease of the production cost for the user sectors; to use for the determination of the volume indicators of the activity of enterprises the accounting prices with incentive markups, which are determined in conformity with the prevailing statute.

In order to increase the interest of enterprises in updating the products being produced, it is advisable to use differentiated standards of the deductions from the profit for the incentive funds for previously produced and new products. The introduction in 1964 of increased standards of the deductions from the profit for the funds of enterprises of up to 15 percent from new products instead of 4 percent from previously produced products created at that time a significant stimulus for the updating of products. However, subsequently this version was undeservedly forgotten. It is advisable to establish two standards of the deductions from the profit for the budget: from series-produced products and a more favorable standard over a period of 3-5 years from the output of new series-produced products.

This suggestion can easily be "inserted" in the large-scale economic experiment which is being conducted in five sectors of industry. The advantages of such a procedure reduce to the following: the achievement of a greater balance in the national economy, since the entire amount of the profit, including from the incentive markups on wholesale prices, will be reflected in the financial plans of the sectors; the delivery of equipment without the payment of incentive markups to the client sectors will enable the latter to stabilize to a significant degree the output-capital ratio and to realize fully the cost accounting economic impact from the introduction of new equipment (the incentive markups on wholesale prices are established, as a rule, in accordance with the maximum impact which is obtainable by the basic user, while for other users it might not be realized. This circumstance has been repeatedly noted in economic literature); the increased standard of the deductions from the profit for internal needs from the new products being produced will make it possible to link the obtaining of the cost accounting impact of the supply enterprise more closely with the scale of production of the newly assimilated products, since it will create a constant and stable stimulus for the increase of the scale of production of new products up to the moment of the complete meeting of the needs for them. At the same time a long-term economic interest in the constant updating of the products being produced is created in the collective, since a significant differentiation of standards with respect to obsolete products and products being new assimilated is possible.



#### FOOTNOTES

1. The standard is determined in accordance with the standard net output for only four sectorial ministries.
2. Only the Ministry of Heavy and Transport Machine Building constitutes an exception--the share of the incentive markups for it in the total amount of the unified fund comes to 17.9 percent.
3. K. Marx and F. Engels, "Soch." [Works], Vol 47, p 363.

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7807

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## BUDGET AND FINANCE

### USE OF FUNDS FOR SCIENTIFIC, TECHNICAL DEVELOPMENT

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[Article by Ye. A. Stoyanov, graduate student of the Moscow Institute of Finance: "The Financial Support of Scientific and Technical Progress"]

[Text] With each year the scale of the introduction of scientific and technical innovations is expanding. In just 3 years of the 11th Five-Year Plan more than 2,328,000 scientific and technical developments were introduced in our country, which made it possible to free an additional 1,639,000 people, an additional profit of over 10 billion rubles was obtained.<sup>1</sup>

A leading role in the determination of the directions and pace of scientific and technical progress belongs to science. Scientific research and development are aimed at the improvement of equipment and technology. They show the most promising means of the development of production, which is inconceivable without the use of the results of scientific research.

The progress of science and technology is a main and decisive condition of the increase of the efficiency of social production and the fulfillment of the national economic plans. In order to achieve the decisive changeover of the economy of the country to the path of intensive development, it is absolutely necessary to ensure the rapid and continuous updating of all the sectors of the national economy on the basis of the current achievements of science and technology. This is one of our fundamental tasks.

At the same time the organization of the work over the entire chain--from scientific research to the introduction in production of new types of machines and equipment--inadequately conforms to the needs of today. The results of a certain portion of the completed scientific research work does not find extensive and prompt use in the national economy, the period of the development and assimilation of new types of equipment and technology is often dragged out. The lack of planned allocations for the development of equipment of the future has a negative effect.

It is important that the assets, which are being spent on the introduction of new equipment, would yield a quick return and would be used in the most promising directions of scientific and technical progress. In recent years it has been possible to decrease the disparity between the growth rate of

expenditures and the growth rate of the additionally obtained profit from the introduction of new equipment. Thus, in 1983 the actual expenditures on the introduction of new equipment as compared with 1980 had increased by 16.5 percent, while the additional profit had increased by 18.7 percent. This could not but also have a favorable effect on the amount of the economic impact from the introduction of new equipment, which came to 45.1 kopecks per ruble of expenditures.<sup>2</sup>

The use of economic levers, particularly financial levers, is of great importance for the solution of the problems of accelerating scientific and technical progress (NTP). The implementation of the achievements of scientific and technical progress requires greater and greater financial resources. The role of finances consists not only in backing the needs, which are connected with the development, assimilation and introduction of new equipment, with the necessary monetary assets. They are called upon to stimulate the acceleration of these processes.

The prevailing system of financial support for the present does not fully create the conditions for the acceleration of the implementation of the achievements of science and technology. It includes funds of monetary assets, which ensure the financing of scientific and technical progress and are formed at various levels of the management of production. Within the large-scale economic experiment, which is presently being conducted, a large role is being assigned to the unified fund for the development of science and technology (YeFRNT) and the production development fund (FRP). For the increase of the interest of production associations (enterprises) in the acceleration of the introduction of the achievements of scientific and technical progress they are permitted to use independently a portion of the assets of the unified fund for the development of science and technology for the performance on their own initiative of planning and design work, as well as for the compensation of the increased expenditures during the period of the assimilation of new equipment. There are also of great importance for enterprises: the specification within state capital investments of the assets of the production development fund--both decentralized with the allocation of resources and centralized; the granting of the right to make additional expenditures by means of a portion of the amortization deductions which are intended for capital repair; the broadening of the sphere of use of long-term credit.

The results of the experiment, which pertain to the use of the unified fund for the development of science and technology and the production development fund, attest to the increase of the possibilities of production associations and enterprises in the increase of the technical level of production. However, the mechanism of the formation and use of the unified fund for the development of science and technology has not yet been completely worked out. The ministry transfers a portion of the assets to the association, that is, reports to it the total amount of the unified fund for the development of science and technology for the year. In turn, the association distributes these assets to each enterprise quarterly with allowance made for the orders submitted to it. The enterprise takes part only formally in the obtaining of assets, since for scientific research and planning and design work scientific research institutes and design bureaus receive money from the current account of the association. The same amount of assets of the unified fund for the



development of science and technology in both the expenditure and the revenue parts is reflected in the financial plan of the enterprise, which frequently paralyzes the initiative of the enterprise in case of joint development and does not promote the increase of interest in the implementation of its results.

It is important to determine what part of the unified fund for the development of science and technology must be decentralized. Apparently, it is necessary to make deductions from the unified fund for the development of science and technology according to standards which are established subject to the need of the enterprise at not less than a specific minimum. The assets, which will be transferred in excess of this amount, should be granted to the lower unit in the form of credits, for which the enterprise can pay after the introduction of some achievements or others of scientific and technical progress. Here not the bank, but the ministry and even the association can act as the so-called creditor. In our opinion, it is possible to replace a portion of the decentralized assets of the unified fund for the development of science and technology with credit in the amount of half of its standard. This will promote the increase of the responsibility of enterprises for the use of the received assets. At present at the level of the production association frequent adjustments of the amounts of the unified fund for the development of science and technology upward for some enterprises and downward for others are occurring. This is connected first of all with the instability of the plans on science and technology. It is necessary to approach more soundly their formulation.

One should also note the fact that the assets of the unified fund for the development of science and technology, in reality, are used only for scientific research and planning and design developments and do not encompass the stages of the assimilation and introduction of new equipment at enterprises. Thus, of the 13 enterprises studied by us of the Moscow Cotton Industrial Association only 2 made in 1983 actual expenditures for measures of scientific and technical progress from the unified fund for the development of science and technology. As a whole for the Moscow enterprises of this association the share of the unified fund for the development of science and technology in the total expenditures came to only 2.1 percent, while for the association it was even less--0.7 percent.

Some economists are raising the question of the uniting of the unified fund for the development of science and technology with the production development fund and of the need to bring them closer to each other, which will speed up the development, assimilation and introduction of new equipment. It is a question of combining the unified fund for the development of science and technology and the production development fund at the level of the association. As to enterprises, here, apparently, the time has come to unite all the funds, from which the expenditures on scientific and technical progress are financed, into a single fund of the financial support of the intensive development of production. This fund would unite the existing funds and assets, such as the unified fund for the development of science and technology, the production development fund, budget allocations; the deductions at the expense of the production cost, amortization deductions, loans of the All-Union Bank for Financing Capital Investments and others. The

effectiveness of these funds today is inadequate and reduces to partial, intermediate results. There is no possibility to trace the allocation of assets for some measures or others of scientific and technical progress, frequently the funds duplicate each other. The internal assets of each enterprise, namely: the amortization for renovation and capital repair; the receipts from the sale of surplus and unneeded equipment; the profit which is left after making all the payments to the budget; the portion of the unified fund for the development of science and technology, which is used by the enterprise, as well as loans of the All-Union Bank for Financing Capital Investments, should become the basic sources of the fund of the financial support of the intensive development of production. Such a fund should be created subject to the necessity of retooling, the service life of machines and units, the physical age of equipment, the possibility of obtaining new equipment and so forth.

At present the fulfillment of the plans and assignments on the development of science and technology is included among the most important indicators, in accordance with which the evaluation of the results of the economic operations of associations (enterprises) is made. In this connection it is necessary to note a number of contradictions, in particular, between the production plan and the plan of measures on new equipment, between the continuous, smooth nature of production and the sporadic nature of the introduction of new equipment. The assignments on new equipment at enterprises are not coordinated with the production plans, the degree of responsibility for their fulfillment and the stimulation are different.

The separation of the plans of scientific and technical progress from the economic results of production should also be grouped with the shortcomings. Proper coordination does not exist between the developers, producers and users of new equipment. The evaluation of their work is made not according to the actual impact from the introduction of new equipment, but by estimate.

Financial planning is the connecting link between the planning of the development of science and technology and its stimulation. The increase of the efficiency of the entire "science--technology--production" cycle in many respects depends on this connection. When distributing financial resources among the basic directions of scientific and technical progress it is necessary to observe the optimum ratios of the allocation of assets for scientific research, the assimilation and introduction of new equipment, the improvement of the production base of enterprises and the increase of product quality. In connection with the existence of current and long-range plans of the development of science and technology, it is also advisable to divide their financial support into long-range and current financial support. Long-range financial support (PFO) should have as a goal the financing of long-term plans of scientific and technical progress and comprehensive goal programs by means of assets of the budget and the unified fund for the development of science and technology, which at present are planned only for a year, and credit. Current financial support (TFO) can be realized basically by means of the internal assets of enterprises (associations) and should be aimed at the increase of the technical level of production.

In our opinion, when planning measures on new equipment it is necessary also to draft the plan of financial support as an additional section to the financial plan (5-year and annual) of the enterprise and association. It will promote: the identification of reserves of the increase of the amount of assets, which are allocated for the financing of work on new equipment; the more sound determination of the necessary amount of financial resources; the reliable reflection of the formation, distribution and use of internal and attracted resources in the indicators of the plan; the calculation of the basic national economic proportions, as well as the sectorial proportions and directions of the development and introduction of the achievements of science and technology for a specific planning period; the assurance of the interconnection of the indicators of the financing of work on new equipment with the indicators of the financing of the basic production operations of the enterprise (association).

An indicator, which should first of all be linked with the volume of output and the expenditures on scientific and technical progress, in our opinion, should be used for the evaluation of the efficiency of the use of the internal assets of associations (enterprises), which are allocated for the retooling of production.

The coefficient of the use of internal assets (K) could be calculated according to the formula:

$$K = \frac{P_{ji}^I}{E_{jt}^I} \times \beta,$$

where P is the amount of additionally produced output due to the introduction of new equipment;

$E_t$  is the total expenditures on measures of scientific and technical progress;

$\beta$  is the share of the internal assets of the enterprise (association) in the total amount of expenditures on scientific and technical progress;

i is the name of the sector (association, enterprise);

j is the period of time.

This coefficient shows how much additional output was obtained per ruble of the total (cumulative) expenditures on all measures and directions of scientific and technical progress due to the use of internal assets.

By means of the proposed coefficient it seems possible to evaluate the level of use of not only internal assets and sources of the financial support of scientific and technical progress, but also the assets which are attracted in a centralized manner. By using it, it is possible to make an analysis, comparing the planned and reporting levels with each other, as well as comparing them with the corresponding levels during preceding periods. The coefficient is calculated both as a whole and for individual measures and directions of scientific and technical progress. The documents, which are envisaged by the



prevailing system of accounting and reporting, serve as the sources of information.

The elaboration of the principles of the efficient, scientifically sound choice of the most effective sources of the financing of scientific and technical progress is connected with the need for a comprehensive approach to the problems of the financial support of the development of science and technology and the rapid introduction of their achievements in production.

#### FOOTNOTES

1. See "Narodnoye khozyaystvo SSSR v 1983 g." [The USSR National Economy in 1983], Moscow, Finansy i statistika, 1984, p 100.
2. Calculated according to "Narodnoye khozyaystvo SSSR v 1983 g.," p 100.

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## FACILITIES AND MANPOWER

### NEW LATVIAN DEVELOPMENT FIRM DESCRIBED

Moscow IZVESTIYA in Russian 30 Apr 85 p 2

[Article by Ye. Vostrukhov and Special IZVESTIYA Correspondent A. Ivakhnov from Riga: "The 'Orient' Looks for a Client; Latvian Experience in Developing and Manufacturing Prototypes of New Equipment"]

[Text] The time for developing scientific and technical innovations, that is, from the idea or invention until the industrial series, often runs 8, 10 and often even more years in the national economy. Even worse is when a sector does not have a design bureau and experimental production capable of carrying out a bold technical idea.

In Latvia now for several years there has been an introductory organization ready to come to the aid of any sector. It requires around 3 years for carrying out the order of the ministry or scientific institution and introducing the invention. The economic effectiveness from this organization's work has been over 2 million rubles during the several years of its existence.

Once at a session of the Collegium of the Latvian Gosplan, they were discussing the question of how to accelerate scientific and technical progress in the republic. Scientists and inventors had proposed many new machines, materials and instruments but the end result was often merely piles of reports and plans on shelves and mock-ups which had been made in primitive shops.

Fridrikh Lekhtman, the chief of the Section for Science and New Technology of the Gosplan, was all inspired with an idea: to establish an intersectorial self-financing organization which would aid the inventors, innovators and scientists in embodying their idea in metal and would turn over a finished innovation to production.

When the decision was taken in the republic Gosplan to establish a new Silava Association in the Minleskhoz [Ministry of Forestry and Timber Industry], he saw to it that here they made provision for a section for working out and manufacturing models of new equipment which would go by the name "Orient." But with one indispensable condition, namely that the section have the right to carry out orders also of other ministries, institutions and departments. One cannot help

but say a good word about the Republic Council of Ministers and Gosplan as they supported the idea of establishing an intersectorial introduction firm by specific measures. "Orient" was included in the list of allocation holders under material and technical supply from the Latvian Council of Ministers. Lekhtman was to head this section.

Here they employ 22 designers, 5 of which are chief project designers and the remainder are leading designers. In terms of their experience and creative potential, each is capable of leading involved developments. They are the firm's "think tank." The section has about 30 employees of the highest skill. When necessary, depending upon the nature of the next order, specialists are temporarily called in as consultants when they are essential for carrying out a specific job, for example, electronics specialists. A separate fund (the planners call it "humanless") makes it possible to call in for consultation and temporary technical leadership the scientific co-workers of higher institutions of learning and academy institutes.

In operating on the principles of cost accounting, "Orient" provides aid to the scientific subdivisions which do not have their own design bureaus or experimental shops and embodies their promising ideas and plans in metal.

In the shops they have installed scores of the most modern equipment, chiefly universal. For filling particularly complex orders, under contract they frequently employ the equipment of other enterprises.

A few words about the firm's "order portfolio." Each year, Lekhtman sends out to the ministries and to individual republic enterprises letters offering his services. In response come requests to manufacture non-standard equipment, automatic equipment and automatic lines. Many seek help in working out various technical specifications. In a word, there are many requests but the plan includes the work based upon inventions which promise high effectiveness in introduction.

Here, too, the doors have not been closed to the individual inventor. Moreover, F. Lekhtman himself at times seeks them out. For example, in a technical journal he read about a press for manufacturing briquettes from chips, peat or whatever. In size these were almost the same as were sold to us by Western firms while productivity was 10-fold higher. The developers of the invention were the Latvian specialists of the peat industry E. G. Veyde and G. P. Kurilov. The leaders of "Orient" persuaded Genadiy Pavlovich [Kurilov] to come to work in the section and head up the manufacturing of the very promising machine. Having just started work on the plans, Lekhtman called up many enterprises, found orders for the press and concluded contracts.

Also interesting is the history of another development here. "Orient" was offered to design an automatic machine for wrapping small coated cheeses. They produced not only the machine but also an entire line for producing these cheeses. However, in the republic someone doubted the workability of the line. They had to find purchasers for it outside. At present, a unit is operating perfectly in the city on the Neva and the Leningraders are requesting that another several such lines be produced for them. It is also being requested both in Latvia and other republics. "Orient" cannot fill all the orders. But talks



are now underway to manufacture a series of automatic machines at one of the enterprises of the Ministry of Machine Building for Light and Food Industry and Household Appliances.

The spectrum of the firm's developments is very broad. For instance, several months ago it was suggested they replace the labor-intensive metal ring which holds ventilating and other piping with polymer. Now they have ready elastic sleeves with a seal applied to them and these make it possible to connect the sections in just 6 seconds. In the Baltic alone the use of this innovation will mean a savings of a half million rubles a year. A number of interesting machines has been developed and is being developed for easing monotonous manual labor in light industry. For the utility systems they have designed an emulsifier which makes it possible in boilers to save up to 3 percent scarce diesel fuel. It has turned out that it is equally effective on seagoing vessels. In the shops of "Oriont" they are making fundamentally new aerators which are designed, for example, for pumping fresh air under pond ice. These devices are already being incorporated in the plans of new fish farms.

This firm also has one other important aspect in its activities which our enterprises so need, namely consultation. It is possible to come here for skilled, scientifically sound advice on questions, for example, of organizing labor and management. In particular, for problems of establishing the advisability or, on the contrary, inadvisability of carrying out major decisions. For example, it was recommended that the Riga Music Factory not establish its own shop for pressing sawdust. It was discovered that it would be better to build one large shop for all the enterprises of the republic Ministry of Local Industry. The toy factory was recommended to convert to a more progressive method of soldering in producing its products.

Our article is not to merely extol "Oriont" and its leaders. We are confident that the time is not far off when similar firms will be set up in all the republics and in many major ministries. For this reason we have endeavored to obtain answers to questions which would inevitably arise for their future organizers.

"What are the financial relations between the section and the clients?"

"We draw up a contract with them," replies F. Lekhtman, "in which we indicate the cost of all stages of the work. Appended to the contract is a calendar plan, a calculation of the innovation's economic effectiveness and the appropriate documents. The funds for everything done by us are turned over to an account of the Silava Scientific-Production Association, and a portion of these goes to pay bonuses of the "Oriont" employees for developing the new equipment. According to the current statutes, a co-worker during a year can receive up to 6 months salary in bonuses."

"When is an order considered filled according to the contract?"

"A finished example in metal or an experimental batch of products is turned over to the client along with a set of technical specifications. Then 'Oriont' keeps track of the introduction of the work and provides technical aid to the client in installing and adjusting the equipment. The chief or leading designer and an experienced machinist can be sent out. They remain there until the product is in production fully."

"But certainly many of your innovations are needed not only in the republic but also in other regions?"

"In this instance, we offer the corresponding ministries or their leading institutes to develop the technical specifications for them for an industrial model or series production. This is precisely how industry will begin producing the aerator and the automatic line for producing the coated cheeses. There are also other developments which we are ready to turn over for mass series production."

"What is the technical level of the innovations developed by you?"

"In actuality one out of every two developments is based on inventions and the authors of many of them are our co-workers."

"To the score of 'Orient' which numbers a little more than 50 persons there are already around 100 introduced highly effective developments. There are even more of them planned in the order portfolio. Is there not a reserve for increasing the firm's output in the new future?"

"In a comparatively short period of time, our section has won authority and proven its viability and necessity, finally. The republic directive bodies realize this clearly. Recently a decision was approved to turn over to us extensive facilities in a former plant. In the near future we could increase the production volume by 2- or 3-fold. But this is a difficult question. Certainly it is not one merely of new shops. Our hands are tied by existing as part of the Silava Association. It would be much better, for example, to put us under the republic gosplan as has been done, for instance, with an analogous introduction organization in Azerbaijan. We dream of taking over one or two design organizations among those which now operate ineffectively as well as organizing our own strong patent and licensing service. We also have our own ideas about improving financing and material-technical supply. In a word, we see 'Orient' as a major scientific-production association which will be capable of tasks of any complexity.

10272

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## FACILITIES AND MANPOWER

### INTEGRATED SCIENCE-PRODUCTION ORGANIZATION IN LITHUANIAN VIEWED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 May 85 p 2

[Article by A. Zhukauskas, vice president of the Lithuanian Academy of Sciences:  
"The Orbit of a Complex"]

[Text] If one speaks about a fundamental turn toward the path of intensification, this can be achieved only on the basis of fundamentally new ideas which are provided by fundamental science. One might ask, why does the product of fundamental science often take an extremely long time to reach the consumer? I am afraid that the presently accepted division of science into fundamental and sectorial and, actually, into departmental, has become one of the main barriers on the path from the idea to its actual embodiment.

One could give many examples where the sectorial scientific research institutes have refused to take up the baton from the academy collectives and VUZes. Or they have conducted applied research and engineer studies at such a pace that the idea itself became out of date. It is a paradox that there are no objective factors for such "opposition." The practice of recent years has clearly shown that a scientific collective which limits itself to just fundamental research can be likened to a sterile flower: regardless of the lush flowering a majority of its seeds do not sprout. Equally an applied institute which endeavors to solve only specific problems of a sector rapidly "runs out of breath." Its activities are deprived of a scientific nature, assuming the form of "first aid" to eliminate production "bottlenecks." Clearly, only the organic interaction of academy and sectorial science can actually accelerate technical progress. What impedes this? Most often, psychological or prestige motives which are often so strong that all attempts to "build bridges" are without any result. The justification (let me not conceal that they are not devoid of grounds) is usually found in references to the fact that fundamental research presupposes "raw" proposals which require great working up. Hence the question has arisen of broadening the limits of responsibility for the academy institutes.

For example, in the institutes of the Lithuanian Academy of Sciences there is an unbreakable rule: fundamental research should have the ultimate goal of developing into practice. This demand has been reinforced not only in their annual plans which include applied subjects along with fundamental research. We endeavor in every possible way to develop the experimental production of the institutes themselves, to utilize the production capabilities of the involved enterprises in the final stage of the work and involve their designers and production engineers.

For example, take our Institute for Chemistry and Chemical Technology. The results of its activities have clearly been felt in the plating shops of many enterprises. Rigid demands on reliability and durability for many types of equipment have forced the producers to pay increased attention to the properties of electroplating. The constantly increasing production volumes have forced them to work for maximum intensification and automation of the employed production processes.

In focusing on these demands, the institute's scientists and specialists have developed 85 new production methods, a predominant majority of which are original and based upon certificates of invention. These developments have been introduced in almost 900 enterprises in the nation, including such automotive giants as the ZIL [Automotive Plant imeni Likhachev], VAZ [Volga Automotive Plant] and KamAZ [Kama Motor Vehicle Plant]. Each year they produce an economic effect of 17 million rubles, saving here 4,500 tons of nonferrous metals.

Profound research and development underly these successes of the institute. But a major role is also played by its own experimental production facilities. These make it possible for the scientists here to try out new ideas and then rapidly bring them to the state of a production method ready for actual use. In parallel the institute participates in organizing the production of new chemical substances or their compositions needed for realizing these processes. This significantly shortens the time of their introduction.

The policy followed by our academy of establishing experimental production under the institutes (with there now being 11 such production facilities) has fully justified itself. An opportunity has appeared of bringing the results of much fundamental research to the level of "take and introduce," and this has increased the interest of the production workers. This can be seen not only from the increased number of economic contracts which last year financed almost one-half of the projects carried out, but also the economic effect from the introduction of the developments of the academy institutes has risen significantly. While over the entire previous five-year plan this was 37 million rubles, over the 4 years of the current one, it is already 74.5 million. By the end of the five-year plan, we hope to bring it up to 95 million rubles.

From this it can be concluded that for many academy collectives, experimental production is an urgent necessity. This would broaden the limits of responsibility and make it possible to concretize the research results and accelerate their move into practice. But something else is also well recognized: the innovations of our institutes are often employed at one or two enterprises, although the effect from them could be immeasurably greater if they were taken up by the entire sector. For this reason we have not refused to "build bridges" between fundamental and sectorial science when this offers broad opportunities for producing the academy developments.

The sectorial scientific research institutes possess significant forces of designers and production engineers and these are clearly in short supply in the academy institutes. For example, all the experimental production facilities of our academy employ a total of 800 specialists. Moreover, these scientific research institutes can rely on the research laboratories, design bureaus and production services of the enterprises and on their production facilities.



This makes it possible to carry out introduction on a broad front. On the other hand, there are many sectorial institutes where for every 1,000 engineers there are just 15 or 20 candidates of sciences. Clearly it is difficult to count on profound research with such forces.

Over many years we have sought a form of collaboration with the sectors which would make it possible to reconcile the interests of academy science, the sectorial scientific research institutes and the enterprises. As a result the idea developed of scientific-production complexes which bring together collectives with different departmental affiliation to solve practical problems. The first such complex, "Elektronika" [Electronics], set up 3 years ago, included two academy institutes, four sectorial ones, two VUZes and ten enterprises. Regardless of the fact that it operates on volunteer principles and economic contracts remain the basic means of coordinating the efforts, the partners are united by inter-related work plans with controllable dates and clearly designated end results. The task of the complex is to develop new articles with the highest parameters, automation and robotization of production at the Lithuanian radio electronic and electrical engineering enterprises.

The purpose of such scientific-production complexes is to concentrate efforts and achieve an integrated approach to the most complicated problems which a single collective is incapable of solving. The means for achieving the goals is in mutual help. The incentive is a common interest in the end result as both academy and sectorial science gain an opportunity to realize their developments while production increases its technical level with the immediate involvement of scientists. It is no accident that the membership of "Elektronika" has been constantly growing.

Over the 3 years that "Elektronika" has existed, over 100 developments have been carried out within it and for just its participants these have produced over 5 million rubles of economic effect. The ministries intend to employ some of these at related enterprises. At present, the partners' efforts are focused on such problems as working out ASU [automated control system] and introducing microprocessor equipment for controlling the production of cinescopes at the Panevezhis Ekranas Plant as well as television equipment at the Shyauliyay Television Plant. Along with improving the quality and the technical level of production for the TV sets, here it is also a question of creating specialized integrated circuits and semiconductor sensitive pick-ups for machine tool building and electrical engineering enterprises. Development is also underway for equipment for the machine designing of radiometering and electronic equipment. Particular attention has been given to creating and developing the production of new radiometering equipment for medical diagnosis. In a word, the activities of "Elektronika" have already overstepped the republic's boundaries.

The successes of "Elektronika" caused the Lithuanian Academy of Sciences to employ this highly effective form of interaction between production and fundamental and sectorial science in other areas, too. For example, the "Gal'vano-tekhnika" [Electroplating Equipment] Complex is being set up on the basis of the Institute for Chemistry and Chemical Technology. Within this specialists from hundreds of plating shops in various corners of the nation will become the partners of the scientists. Under the scientific leadership of the Physics Institute, we intend to organize the "Lazery" [Laser] Complex which would ensure the

development and introduction of highly efficient laser technologies and automated equipment for laser mechanics.

Like "Elektronika," the new "Gal'vanoteckhnika" and Laser scientific-production complexes will operate on volunteer principles. Councils made up of representatives of the partners should head these activities. But even now it is clear that for day-to-day management and control over the course of work, special persons are essential. Equally the effectiveness of such complexes will increase greatly if they will be able to concentrate the forces, resources and means allocated by the partners in their own hands. For this, such complexes must be given the necessary legal and economic status and their rights and duties legislated. On this question, in our view, the initiative belongs to the USSR State Committee for Science and Technology.

10272

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## FACILITIES AND MANPOWER

### MORE EFFECTIVE USE OF YOUNG SCIENTISTS URGED

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 27 Apr 85 p 2

[Article by Doctor of Medical Sciences S. Kolesnikov, chairman of the Council for Young Scientists and Specialists Under the Komsomol Central Committee: "To Work, Youth of Science!"]

[Text] The April Plenum of the CPSU Central Committee called accelerated scientific and technical progress the main strategic lever for intensifying the national economy.

The Chairman of the Council of Young Scientists and Specialists Under the Komsomol Central Committee, Doctor of Medical Sciences, S. Kolesnikov, reflects on the role of youth in resolving the tasks posed by the party.

Recently there has been greater interest in the scientific youth. And this is no accident.

Cooperation between the Komsomol and science is a long and good tradition. Over the years that the Komsomol has existed, virtually all generations of today's Soviet scientists and specialists have passed through its school. Suffice it to say that more than 1,000 of them have been awarded Lenin Komsomol prizes.

Under present-day conditions, scientific, engineer and technical labor is becoming an evermore massed type of labor activity. Young people under the age of 30 comprise almost one-half of all the scientific-technical intelligentsia. Just within the Komsomol membership there are 121,000 science associates, around 2,000 doctors and candidates of sciences. It is very important to correctly organize this enormous force of the best trained youth and to channel its energy into specific, creative involvement in raising the effectiveness of social labor.

At present, work with young scientists and specialists has assumed a planned nature. Many thousands of enthusiasts are involved in forming and implementing the programs for accelerating scientific and technical progress as based upon the chief problems of the republics, krais and oblasts. Their algorithm encompasses all elements of work from the posing of a pertinent problem to its actual implementation through the comprehensive creative youth collectives (KTMK).

In this manner it is possible to realize the notion that it is not enough to merely propagandize introduction but above all it is essential to disclose and eliminate the specific difficulties which impede scientific and technical progress. The KTMK have become firmly established. At present, there are over 16,000 of them in the nation. And the effect has been striking. Some two or three times faster than usual they solve the problems of developing and particularly introducing new equipment.

They also contribute to the early development of the young specialist. Nevertheless, up to the present we have not yet resolved the legal and financial aspects of the work of these collectives which have produced a substantial effect in the area of introduction. The allocating of materials and incentive measures have not been established. These problems have been raised repeatedly before the Ministry of Finances the Minvuz [Ministry of Higher and Secondary Specialized Education], the Goskomtrud [State Committee for Labor and Social Problems] and the GKNT [State Committee for Science and Technology].

The youth, as is known, produces over one-half of all the inventions in the nation. Recently, the employment of functional-cost analysis (FSA) methods has proven effective. The introduction of FSA in the electrical engineering industry over the 2 years of the experiment has made it possible to save more than 14,000 tons of rolled metal, 3,000 tons of lead, 20 tons of silver and conditionally free 1,500 employees. There are also nontraditional forms of work in propagandizing scientific and technical achievements. For example, there is the "Auction of Scientific-Technical Knowledge" which is conducted annually at the Novokramatorsk Machine Building Plant Production Association.

One is concerned by the presently observed shortage of young middle-level personnel and production organizers. In Leningrad, since 1978, they have been effectively operating a school for production organizers which has been organized by the Komsomol and the Scientific and Technical Propaganda Club and this has been completed by more than 500 persons. At a number of enterprises, following the example of the Omsk Elektrotokhpribor [Electric Precision Instrument] Plant, Youth Weeks are held where the leadership functions are assumed by young specialists.

The questions of developing the nation's power supply hold an important place in our work. For coordination purposes contracts have been concluded between the soviets and the Komsomol committees of a number of enterprises in Azerbaijan, Sverdlovsk, Leningrad Obkoms, the Moscow Gorkom and the Tyumen and Tomsk Komsomol Obkoms. The young scientists have contributed to the early completion of construction on the export Urengoy--Pomary--Uzhgorod Gasline. Under the Mingazprom [Ministry of Gas Industry] a staff for youth sponsorship has been organized and in the institutes there are Komsomol-youth posts of developer supervision as well as groups for the effective elimination of "bottlenecks."

The President of the USSR Academy of Sciences, A. P. Aleksandrov, has cited as one of the main tasks up to the end of the century the broadest utilization of computer equipment and automation in all spheres of activities. At present, microprocessors are moving into not only production but are also cracking the doors of our apartments.



Developing skills for using computers is already becoming a focal point in the classroom. Schools similar to those organized at the Novosibirsk Akademgorodok by Academician A. P. Yershov in Dubno, in Alma-Ata, Zelenograd, at the Apatit Production Association of Murmansk Oblast could be established virtually at any computer center. They train programmers and teach the young people to think for the future and to adapt rapidly. At present, we acutely need the physical facilities for such work in the schools or UPK [job training centers]. We must more quickly convert to the "electronic accounts" of the 20th Century. Mastering the programming language should become essential for each young scientist and specialist.

A number of new, extremely crucial tasks now confronts the scientific youth in line with the school reform. I am acquainted with the work done by the small 'Iskatel' [Pioneer] Academy of Sciences in Simferopol, the Scientific Society of Students in Chelyabinsk, the Viitorul Society in Moldavia and can say with confidence that today's pupils and tomorrow's involved researchers and thinking workers will be grateful all their lives for the developers of this movement. The main thing at present is to introduce the acquired experience and the time-tested forms of the involvement of the scientific youth in the concerns of the middle and higher school. Here it is very important to have prompt support from the Minpros [Ministry of Education] and the AUCCTU. Here it is important to organize summer specialized schools which are combined with the work quarter, scientific societies of students and youth VOIR [All-Union Society of Inventors and Innovators] organizations and the holding of public reviews of knowledge, olympiads and competitions in the given specialties. Great attention must be given to the now extremely rare circles of young social scientists.

In recent years, young sociologists and philosophers have done good work. It must not be forgotten that the effective participation in the construction of our society depends largely upon ideological position. Under the conditions of the shortage of sociologists in our nation, the organizing of the 2-year young sociologist university has been a specific and beneficial matter and the first graduating class will be this year. The search for the methods and forms of combining scientific-production and aesthetic indoctrination of the youth is also an important area of work. Such experience can now be found in the youth specialist clubs in Lithuania, Georgia and Tashkent.

There are reserves but we must not be complacent and must always remember that the shortcomings of our science and the scientific research institutions are also shortcomings in the work of the scientific youth.

10272

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## TRAINING AND EDUCATION

### ROLE OF BELORUSSIAN VUZES IN SCIENCE, ECONOMY TRACED

Minsk SOVETSKAYA BELORUSSIYA in Russian 21 Apr 85 p 3

[Article by Candidate of Technical Sciences, Docent, B. Kaledin, chief of the Science Administration of the Belorussian Ministry of Higher and Specialized Secondary Education: "Holidays and Everyday"]

[Text] The republic scientists of the higher school are greeting their holiday, Science Day, in a good mood. Important results for science and practice have been obtained, research has been completed on more than 400 subjects and the targets of 138 specific and scientific-technical programs of varying levels are being successfully fulfilled.

We would particularly like to note the successes of scientists in the Belorussian and Gomel State Universities, the Belorussian Polytechnical Institute and the Minsk Radio Engineering Institute. The USSR State Prize in the area of science and technology in 1984 was awarded to the dean of Gomel State University, Academician of the Belorussian Academy of Sciences, B. V. Bokut'. Belorussian state prizes were awarded to the prorector for scientific work of the Belorussian Polytechnical Institute, Corresponding Member of the Belorussian Academy of Sciences, A. V. Stepanenko, the head of the Zoology Chair of BGU [Belorussian State University], Prof I. K. Lopatin, the docent of the Belorussian Literature Chair of the same university D. Ya. Bugayev, the docent of the microelectronics chair of the Minsk Radio Engineering Institute A. G. Chernykh and the head of the chair of monumental-decorative art of the Belorussian Theater Arts Institute, Prof T. Kh. Vashchenko.

The effectiveness of the work by the scientists of the Belorussian higher school can also be described by the publishing of over 200 monographs, more than 100 textbooks and teaching aids, around 40 inter-VUZ collections of scientific works and almost 10,000 scientific articles. The innovativeness of the research and development by the workers of our VUZes is confirmed by the receiving of around 1,400 decisions to issue certificates of invention, 28 patents and by the concluding of two licensing agreements with foreign firms. At present, one out of every three inventions in the republic is developed within the walls of the higher school.

Other indicators of the effectiveness of scientific activities also show that the science of the Belorussian higher school holds one of the leading places in the nation. The proportional amount of the most important subjects has reached

almost 80 percent and over 740 developments have been introduced into production with an economic effect of 77.6 million rubles. The per-ruble return on expenditures was over 2 rubles. This is the highest indicator among the ministries of higher education in the Union republics.

The successes of VUZ science has largely been aided by the improved planning and management of scientific research both within the VUZes and also in the ministry. Particular attention has been given to strengthening long-term ties of the higher school with the national economic sectors and to deepening the integration of VUZ science with production. This process is based upon the joint orders and coordinating plans of the Belorussian Minvuz [Ministry of Higher and Specialized Secondary Education] with the Union and Union republic ministries and departments. As a result the time has been shortened and the scale broadened for introducing the results of VUZ research into practice. The device developed at the Grodno University for automating operating conditions of milking machines has been successfully tested on the kolkhozes of Grodno Oblast and has been recommended by the interdepartmental commission for series production. The economic effect from employing this device can reach 20 million rubles.

We should also point to the active introduction work carried out by the scientists from the Minsk Radio Engineering Institute. For example, under the scientific leadership of the Honored Scientist and Technician of Belorussia, Prof A. P. Dostanko, developments with a total economic effect of over 5 million rubles have been successfully put into series production (at the Integral PO [Production Association], the MPO [? a production association] imeni V. I. Lenin and others.

Virtually all of these developments have been protected by certificates of invention.

The most substantial contribution to accelerating scientific and technical progress in the economy has been made by our pacesetters the BGU and the Belorussian Polytechnical Institute. Such institutes as the Belorussian Technological Institute, the Novopolotsk Polytechnical Institute, the Gomel Polytechnical Institute, the Brest Construction Engineer Institute and Gomel State University have done a great deal for substantially increasing labor productivity and reducing the share of manual labor and for raising the technical level of the produced product at those enterprises for which they have carried out scientific research. In a word, the scientists of the republic higher school have something to be proud of and something to show.

However, there is no reason for complacency and indifference. Moreover, one cannot help but see that the volume and pace of VUZ research and its influence on practice lag substantially behind both the republic and national needs as well as the possibilities of the higher school itself. This poses for its scientific collectives important and largely fundamentally new tasks in accelerating the process of integrating science and production. We have a number of unused reserves for this.

In particular, there is still a great scattering of scientific forces, particularly in terms of economic contract projects. A good deal of secondary, narrow-applied research is being carried out aimed at developing particular technical

improvements which at times are destined for obsolete production. Hence for certain VUZes (Grodno State University and the Novopolotsk Polytechnical Institute) there remains the urgent question of concentrating forces on solving significant scientific and technical problems and increasing the share of the most important subjects. At a number of VUZes there is still not strict control over the rational utilization of money, over the organization and execution of scientific research as well as proper exactingness placed on its leaders and executors in terms of increasing responsibility for the level and end results of the work.

One cannot help but see that many problems and shortcomings in the development of science in the higher school are a consequence of an obvious underestimation of its importance and role in training highly skilled specialists and in developing scientific and technical progress.

The broad use of specific program methods for organizing research and the increased amount of the most important scientific subjects being carried out in the VUZes pose with particular acuteness the problem of strengthening state discipline in science. But what frequently happens is this. The head or financing sectorial organization, without allocating sufficient funds to support the work assigned to the VUZ, forces it to conclude economic contracts on subjects close to the specific program. As a result, instead of the concentrating of scientific forces, one observes their unjustified scattering, the financial possibilities of the institutions of learning are restricted and conditions are complicated for the development of their physical plant.

The most "painful" place in VUZ science, very likely, remains the slow pace and limited scale of the practical introduction of scientific research results. Examples of the extensive practical utilization of highly efficient developments are offset by the predominant share of so-called "individual" developments when the scientific results are used only by the direct client. Often promising, economically and socially justified innovations remain for years as models and plans and patented objects are produced nowhere by industry.

A majority of our VUZes do not have their own experimental production facilities and this greatly complicates the process of "bringing" their innovations up to the required technical level. Here very beneficial would be help from the sectorial ministries and departments. Unfortunately, they do not fully consider the capabilities and needs of the higher school in forming and carrying out their technical subjects, they do not sufficiently involve the VUZes in carrying out major, promising tasks and far from always help in manufacturing prototypes. Often the VUZes encounter a reticence of the enterprises, ministries and departments to use the VUZ developments and a desire to underplay the economic effect from their introduction.

Two examples can be given in confirmation of this. Through a proposal of the Belorussian Gosplan that the Belorussian Minvuz be given a list of scientific-technical problems which the VUZes could help in solving, a number of the republic ministries (the Ministry of Installation and Special Construction, the Ministry of Agriculture, the Ministry of Industrial Construction, the Ministry of Forestry and others) replied that they did not have such problems.



The Belorussian Ministry of Agriculture has not shown particular interest in the broad use of the already-mentioned device for automatic control of the milking process developed at Grodno State University, although this instrument makes it possible to increase milk yield by 5-10 percent and reduce the cow mastitis rate.

With such an attitude on the part of the ministries and departments to VUZ science, it is hard to count on the maximum use of the higher school's scientific potential. In our view, we must increase the responsibility of the industrial ministries, enterprises and organizations for introducing and utilizing the scientific results and plan for them an economic effect depending on the expenditures for economic contractual research.

There are many problems in the development of VUZ science, many of them are being resolved by the VUZes and the ministry, but in a number of instances we need effective help.

The results of the 4 years of the 11th Five-Year Plan indicate that the workers of the republic higher school will endeavor to effectively carry out the tasks confronting VUZ science. One cannot doubt that 1985 will bring new successes to our VUZes in raising the effectiveness of scientific research and the introduction of their results into the national economy. This will make it possible for the higher school to successfully carry out the quotas of the current five-year plan and properly greet the 27th CPSU Congress.

10272

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## TRAINING AND EDUCATION

### ORGANIZATION OF RESEARCH ON SECONDARY SPECIALIZED EDUCATION

Moscow SREDNEYE SPETSIALNOYE OBRAZOVANIYE in Russian No 3, Mar 85 pp 2-5

[Article by Professor A. Ya. Savelyev, director of the Scientific Research Institute of Problems of the Higher School: "Improve the Organization of Scientific Research in the Area of Secondary Specialized Education"]

[Text] The implementation of large-scale comprehensive socioeconomic programs and the changeover to the intensive means of the development of the economy at the stage of mature socialism require the radical improvement of the training of specialists with a higher and secondary specialized education. Taking into account the present scale and level of development of the higher and secondary specialized school and the nature of the tasks, which have been posed by the party and government for the system of vocational education, the need for the conducting of comprehensive and thorough scientific research, which ensures the quickest and most effective accomplishment of these tasks, is becoming obvious.

The Scientific Research Institute of Problems of the Higher School is the main organization for the conducting of theoretical and applied research in the area of higher and secondary specialized education. The institute also performs the functions of the coordinating center of scientific work on the problems of higher and secondary specialized education, which is being performed at many higher and secondary specialized educational institutions, scientific and educational methods offices attached to the ministries of higher and secondary specialized education of the union republics, sectorial ministries and departments, which have educational institutions subordinate to them.

The uniting of the efforts of scientific collectives on the study of the most important problems of the development of higher and secondary specialized education regardless of their departmental subordination, the elimination of the study of minor themes and parallelism in research, the assurance of the exchange of scientific information and the elaboration of recommendations, which are aimed at speeding up the introduction of the results of scientific research work in the practice of the work of educational institutions and the organs of their management, are the task of the Scientific Research Institute of Problems of the Higher School in the coordination of scientific research work.

The coordinating plan of scientific research work on the problems of higher and secondary specialized education, which is formulated by the institute jointly with higher educational institutions and tekhnikums, and the Statute on Coordination, which are approved by the USSR Ministry of Higher and Secondary Specialized Education, serve as the basis of the coordinating activity of the Scientific Research Institute of Problems of the Higher School.

In all 373 higher educational institutions, tekhnikums and other organizations were included as coperformers in the coordinating plan for 1981-1985. However, experience showed that the plan did ensure the proper concentration of scientific forces on the solution of fundamental problems and that many studies were poorly coordinated both with each other and with the ultimate goals of the higher and secondary specialized school. In spite of the fact that many studies, which were included in the plan, ended with the elaboration of specific recommendations, which were aimed at the increase of the quality of the educational and training process, the improvement of the system of the planning and forecasting of the development of higher and secondary specialized education, the solution of a number of economic problems of the higher and secondary specialized school and the improvement of its management, as a whole the effectiveness of research is still inadequate, its results for the present are not having a transforming influence on the level of training of specialists. It must be said that the themes on questions of the secondary specialized school are poorly represented in the coordinating plan of scientific research work for 1981-1985, but even those which are planned are being supported primarily by the forces of the Scientific Research Institute of Problems of the Higher School. A number of tekhnikums of the USSR Ministry of Nonferrous Metallurgy and the Ministry of the Electronics Industry expressed at first the wish to take part in the research, but, unfortunately, some time later they terminated cooperation with the Scientific Research Institute of Problems of the Higher School, never having submitted reports on the performed work.

The higher educational institutions of the country are poorly involved in the research on the problems of secondary specialized education, especially in such directions, which are important in light of the principles of the reform of the general educational and vocational school, as instruction and communist education. At the same time one should note the examples of the fruitful cooperation of the institute with tekhnikums of the Ministry of the Shipbuilding Industry, the USSR Ministry of Ferrous Metallurgy, the RSFSR Ministry of the Forestry Industry, the USSR Ministry of the Meat and Dairy Industry and the RSFSR Ministry of Consumer Services in the formulation of standard unified programs of practical production work and with tekhnikums of the Ministry of the Shipbuilding Industry and the USSR State Bank in the development of educational methods complexes of subjects.

During the current five-year plan the Scientific Research Institute of Problems of the Higher School has conducted a number of interesting experimental and applied studies, the results of which are gradually being introduced into the activity of the secondary specialized school. In particular, a comparative analysis of the content of general educational training at secondary specialized educational institutions, secondary

vocational and technical schools and the secondary general educational school, as a result of which changes, which ensure a common level of general educational training at these educational institutions, were made in the curricula, was made jointly with the Scientific Research Institute of the Content and Methods of Instruction of the USSR Academy of Pedagogical Sciences and the Scientific Methods Office for Secondary Specialized Education of the USSR Ministry of Higher and Secondary Specialized Education. For a number of years extensive experiments on the formation of the student bodies of *tekhnikums* for critical specialties without entrance examinations, as well as an experiment on the training of technicians from among the graduates of secondary vocational and technical schools in a shortened time have been conducted under the scientific supervision of the institute. The conclusions drawn in accordance with the results of the experiments have already in part found reflection in the Rules of Admission to Secondary Specialized Educational Institutions.

Among the tasks of prime importance and difficulty, which require a comprehensive systems study, there stands out the task of improving the content of education at all its levels in conformity with the trends of development of science, technology, production and culture. For the purpose of improving the content of secondary specialized education our institute has performed a number of jobs, among which it is necessary to note the procedural recommendations on the drawing up of curricula in the specialties of secondary specialization, the recommendations on the drawing up of standard unified programs of practical production work for secondary specialized educational institutions, the mock-up of the educational methods complex of a subject and instructions on its development and others. Taking into account the importance, scale and essential specific nature of secondary specialized education, the Scientific Research Institute of Problems of the Higher School is constantly taking the necessary steps on the development of comprehensive research in this area by orienting toward the elaboration of the problems of secondary specialized education all the scientific subdivisions of the institute, such as the departments of the communist education of students, automated teaching systems, collective-use computer systems, the international experience of training specialists and others.

Thus, for the fulfillment of one of the basic tasks of the reform of the general educational and vocational school--"to equip students with knowledge and skills of the use of modern computer technology, to ensure the extensive use of computers in the educational process"--scientists of the institute developed a strategic concept of the implementation of the program of universal computer literacy in the country, including the school, vocational and technical schools, secondary specialized educational institutions and the higher school, which was made the basis for a set of measures, specific proposals and recommendations on the extensive introduction of computer equipment in the educational process and on the development among students of skills of its use in daily practical activity. This concept received reflection in the joint decree of the All-Union Komsomol Central Committee, the USSR State Committee for Science and Technology, the USSR Academy of Sciences, the USSR Ministry of Higher and Secondary Specialized Education, the USSR Ministry of Education and the USSR State Committee for Vocational and Technical Education "On the Participation of Komsomol Members and Young People



in the Development and Efficient Application of Computer Technology and the Study of the Principles of Its Use."

However, many questions in the area of secondary specialized education cannot be studied and treated thoroughly enough without the extensive enlistment of the instructors of tekhnikums, the science teaching collectives of higher educational institutions, which are capable of conducting educational psychological research at a high theoretical and methods level, and the collectives, which universities, pedagogical higher educational institutions and faculties for the increase of the skills of instructors of secondary specialized educational institutions attached to various higher educational institutions have. Unfortunately, it has to be stated that not one faculty for the increase of the skills of instructors of secondary specialized educational institutions so far has taken part in research in accordance with the coordinating plan of scientific research work of the USSR Ministry of Higher and Secondary Specialized Education. It seems that the management of the higher educational institutes, of which faculties for the increase of skills are a part, should direct attention to this.

At present the Scientific Research Institute of Problems of the Higher School has begun the formulation of the coordinating plan of scientific research work on the problems of higher and secondary specialized education for the 12th Five-Year Plan. The procedure of formulating this plan is specified by the order of the USSR Ministry of Higher and Secondary Specialized Education, by which the problems of scientific research in the area of higher and secondary specialized education were approved and in conformity with which the coordinating plan for the coming five-year plan will be drawn up. When formulating the problems of research the documents of the party and government on the questions of the development of higher and secondary specialized education were carefully analyzed and kinds of "bottlenecks" were identified. Here not only the laws and peculiarities of the development of higher and secondary specialized education as an object of research, but also the achieved level of research work were taken into account. The problems of research were discussed and approved in the scientific councils for problems of the higher and secondary specialized school and in the Collegium of the USSR Ministry of Higher and Secondary Specialized Education.

On the basis of the current demands on the organization of scientific research, the Scientific Research Institute of Problems of the Higher School is attempting to broaden the practice of using goal program methods of the planning and management of research efforts. The difficulty of formulating coordinating plans with the use of these methods stems first of all from the multiple-factor nature of the object of research. At the same time the use of the goal program method of the planning and management of research is yielding positive results. The research performed by the institute jointly with higher educational institutions of the country in accordance with the goal program "The Development and Introduction of Automated Teaching Systems," which in 1984 was commended with the prize of the USSR Council of Ministers, is an example of this.

Scientists of the most different types--educators and administrators, psychologists and economists, physiologists and social scientists,

philologists and systems engineers--elaborated the problems of research in the area of higher and secondary specialized education for the 12th Five-Year Plan. Such comprehensiveness, which is based on the integration of the theory and methods of various sciences, is creating a real basis for the comprehensive study of various components of the educational system and is making it possible to develop the theoretical principles in this area at a qualitatively new level.

In the problems of scientific research work (they are cited in this issue of the journal) six combined scientific directions of research are distinguished: instruction at the higher and secondary specialized school; Marxist-Leninist education and communist training at the higher and secondary specialized school; scientific research activity at the higher school; the economics, forecasting and planning of higher and secondary specialized education; the management of the higher and secondary specialized school; computer technology at the higher, secondary specialized and general educational schools. In turn the directions of scientific research are divided into complex problems and problems, the solution of which receives realization through the elaboration of specific themes.

One should group with the themes, which, in our opinion, are of the greatest interest for workers of the secondary specialized school:

- the determination of the content of education in light of the requirements of social and scientific and technical progress and the development of a set of methods of the flexible reflection in educational methods documents of the changes in the demands on the training of specialists;

- the improvement of the nomenclature of specialties on the basis of the analysis of the existing and long-range requirements of the national economy, the assurance of continuity with the nomenclature of vocational and technical education and the higher school;

- the development of the system of the vocational guidance of school children, students of vocational and technical schools and working young people toward instruction at secondary specialized educational institutions;

- the systems study of the means of optimizing the educational process;

- the study of the means of increasing the effectiveness of the forms and methods of instruction;

- the elaboration of criteria and methods of evaluating the effectiveness and quality of the educational and training process;

- the study of the questions of the continuity of the content, forms and methods of instruction and training in the "general educational school--secondary specialized educational institutions--higher educational institutions" system;

- the didactic aspects of the development and use of means of instruction, which ensure the intensification of the educational process;

--the elaboration of recommendations on the comprehensive approach to educational work in all the directions of communist training;

--the improvement of the forms and methods of checking the knowledge and skills of students.

In connection with the drafting of the coordinating plan for 1986-1990 the institute has to perform much work on the analysis of the drafts of the five-year plans of scientific research work of higher educational institutions, ministries and departments and on the drawing up on their basis of a consolidated plan. The institute faces much work on the identification of the scientific collectives which are interested in conducting scientific research work in the area of higher and secondary specialized education. It is necessary to mobilize pedagogical higher educational institutions and universities for the development of research in this area, it is necessary to attract the attention of graduate students and seekers of degrees to the problems of secondary specialized education. For the conducting of scientific research work it is expedient for instructors of tekhnikums to use more extensively the practical study of the most experienced instructors at the Scientific Research Institute of Problems of the Higher School and sectorial scientific research institutes. And the question of the intensive development of research on secondary education should be examined only from such a point of view. Undoubtedly, the educational methods offices of the ministries of higher and secondary specialized education of the union republics and the sectorial ministries should take a most active part when formulating the coordinating plan of scientific research work, as well as in the organization of research on the problems of secondary specialized education. Moreover, for the purpose of speeding up the introduction in practice of the results of scientific research it is necessary to coordinate the five-year plan of scientific research work with the plan of educational methods work in the area of secondary specialized education, having made the goal program approach the basis. Such a program can be formulated by the Scientific Research Institute of Problems of the Higher School jointly with the Educational Methods Administration and the Scientific Methods Office for Secondary Specialized Education of the USSR Ministry of Higher and Secondary Specialized Education.

In speaking about the organizational mechanism of the management of scientific research work, it is necessary to stress that the real supervision of the fulfillment of the coordinating plan should be carried out at the level, at which the management of educational institutions is concentrated, that is, at which the decisions concerning coperforming higher educational institutions and tekhnikums are made. The responsibility of the ministries of higher and secondary specialized education of the union republics for the organization and results of the research, which is being conducted at educational institutions subordinate to them, is increased by the new statute on the coordination of scientific research work on the problems of higher and secondary specialized education. It also seems advisable to broaden the rights and duties of the scientific councils for problems of the coordinating plan, to coordinate more closely the activity of these councils, the councils of rectors and directors of tekhnikums, the coordinating councils for the management of goal programs of the USSR Ministry of Higher and Secondary



Specialized Education and other advisory coordinating organs. For the present the contact between these organs is inadequate.

Specific tasks in the area of planning and analytical, research and information work, which helps to ensure the management of research, as well as in the area of the organization of the comprehensive introduction of the results of scientific research work are being assigned to the Scientific Research Institute of Problems of the Higher School.

The formulation of a common program of research on each theme and a schedule of operations is an important organizing element of the joint activity of the main organization for the elaboration of a theme with the coperforming organizations. Precisely such a plan should become the specific working document, which reflects the content of the research and outlines its experimental checking by years and the breakdown of educational institutions and other organizations by stages of the work and specifies the time, procedure and form of the stage-by-stage presentation of the results of scientific research work. When drawing up the schedules, the main organizations should implement with the coperformers coordinating measures for the extensive discussion of the coming research and the determination of the necessary material and manpower resources.

The best works in the area of secondary specialized education are published in the journal SREDNEYE SPETSIALNOYE OBRAZOVANIYE, as well as in collections of scientific works of the Scientific Research Institute of Problems of the Higher School and survey reports on the basic scientific directions. Moreover, the Scientific Research Institute of Problems of the Higher School as a sectorial information center accepts original works on problems of higher and secondary specialized education for depositing. The unified coordinating plan on the problems of secondary specialized education and the extensive publication of the obtained results will make it possible to increase the efficiency of the system of the increase of skills and to speed up the introduction in the practice of work of the results of research and the work experience of the best pedagogical collectives.

The implementation of the presented principles and the use of everything of value that has been gained in the process of coordinating work will improve the quality of studies of the problems of higher and secondary specialized education.

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## TRAINING AND EDUCATION

### RESEARCH PROBLEMS IN HIGHER, SECONDARY SPECIALIZED EDUCATION

Moscow SREDNEYE SPETSIALNOYE OBRAZOVANIYE in Russian No 3, Mar 85 pp 6-7

[Article: "The Problems of Scientific Research in the Area of Higher and Secondary Specialized Education (Given in Paraphrase)"]

[Text] I. Instruction at the Higher and Secondary Specialized School

1. The content of the training of specialists at the higher and secondary specialized school:

The determination of the content of education in light of the requirements of social and scientific and technical progress and the development of a set of methods of the flexible reflection in educational methods documents of the changes in the demands on the training of specialists.

The elaboration of the principles and methods of the formation of the nomenclature of specialties.

The elaboration of methods of ensuring the continuity of the content of education in the higher school with the preceding levels: the secondary school, the vocational and technical school, the secondary specialized educational institution.

2. The principles, methods and forms of instruction at the higher and secondary specialized school:

The systems study of the optimization of the forms and methods of instruction.

The study and elaboration of new (active) methods of instruction in their fundamental combination with traditional methods.

The improvement of the forms of the organization of the educational process.

The elaboration of methods of the adaptation of students to the conditions of instruction and psychophysiological recommendations on the increase of the capacity for work and the protection of the health of students and instructors.

The determination of educational psychological means of increasing the effectiveness of the educational and training process.

### 3. Teaching aids at the higher and secondary specialized school:

The didactic aspects of the development of teaching aids which ensure the intensification of the educational process.

The development of methods of increasing the effectiveness of the use of audiovisual aids.

The elaboration of the principles of the efficient supply of the educational and training process with teaching aids.

The elaboration of the scientific methods demands on the quality of textbooks and educational aids.

### 4. The control of the quality of the training of specialists:

The definition of the concept "the quality of the training of specialists," the identification of the factors, which determine its content and the development of the principles and methods of its comprehensive control.

The development of the scientific principles of vocational guidance work in light of the reform of the general educational and vocational school.

The determination of the principles of the formation of the study body at higher and secondary specialized educational institutions and the improvement of the system of admission.

The elaboration of means of increasing the quality of instruction.

The development and improvement of efficient methods of planning the educational and training process and the elaboration of methods support.

The improvement of the organizational forms and methods of evaluating and monitoring the quality of the training of specialists.

## II. Marxist-Leninist Education and Communist Training at the Higher and Secondary Specialized School

### 1. The formation of an integral Marxist-Leninist world outlook in the process of instruction at higher and secondary specialized educational institutions:

The theoretical concept of the improvement of mature socialism and its reflection in the teaching of the social sciences.

The study of the methodological role of materialistic dialectics and political economy in the formation of an integral Marxist-Leninist world outlook.

The scientific methods questions of ensuring unity and continuity in the study of the components of Marxism-Leninism.

The study of the cooperation of the chairs of social, general theoretical and specialized subjects in the strengthening of the philosophical orientation of the educational and training process.

The improvement of the methods of forming high philosophical and methodological standards of future specialists.

The generalization of the advanced know-how of the chairs of the social sciences and questions of the increase of the educational skills of social science instructors.

## 2. The improvement of the system of communist training at the higher and secondary specialized school:

The questions of the development of the theory of communist training in documents of the CPSU and the increase of the role of the party in the organization of educational work at the higher and secondary specialized school.

The peculiarities of the implementation of the principles, forms and methods of communist training with allowance made for the development of all the levels of public education.

The study and improvement of the methods of the communist training of the professors, instructors and associates of educational institutions.

The study of the laws and peculiarities of the formation of high political, moral and esthetic standards of undergraduate and student youth.

The study of the methodological, procedural and organizational aspects of counterpropaganda work at higher educational institutions.

The study of the laws of the formation of the student socialist collective.

The study of the processes of the formation of the personality of the undergraduate and student in socialist society and the elaboration of means of increasing their social activeness.

The study and elaboration of means of increasing the effectiveness of the system of the communist training of undergraduate and student youth.

## III. Scientific Research Activity at the Higher School

### 1. The improvement of the management of scientific research activity and the increase of the contribution of higher educational institutions to the acceleration of scientific and technical progress:

The study of the organizational structures of the management of scientific research activity of the higher school and their improvement.

The elaboration of mathematical economic models and the improvement of the methods of planning scientific research at higher educational institutions.

The study and formulation of norms and standards, standardized procedures and document support of the planning of scientific research.

The improvement of the traditional forms and the analysis of the new forms of the cooperation, organization and service of scientific work between higher educational institutions.

The acceleration and the broadening of the scale of the practical use of the results of research which has been completed by higher educational institutions.

The integration of the scientific activity of higher educational institutions with the scientific institutions, enterprises and organizations of the USSR Academy of Sciences and the sectors of the national economy.

2. The increase of the effectiveness of the use of the scientific potential of higher educational institutions:

The formulation of comprehensive programs of the development and distribution of the scientific potential of the higher school.

The improvement of the interaction of the educational and scientific processes, the development of methods of increasing the influence of scientific research work on the quality of the training of specialists.

The intensification of the scientific labor of professors and instructors, scientific associates, graduate students and undergraduates.

The methods of the monitoring and evaluation of the efficiency of the scientific research work of higher educational institutions, the forms of its organization and introduction.

The study of the peculiarities of the forms of the organization and coordination and the methods of the evaluation of the effectiveness of research on the problems of higher and secondary specialized education.

3. The effectiveness of the participation of undergraduates and students in the scientific research and creative work of higher and secondary specialized educational institutions:

The determination of means of increasing the influence of scientific work on the vocational training and ideological and political education of young specialists.

The intensification of the educational and research processes at the higher and secondary specialized educational institution by the development of the system of the scientific research and creative work of undergraduates and students.

The effectiveness of the comprehensive planning of the scientific research work of undergraduates and the methods of its improvement.



The comprehensive evaluation of the level of the organization, effectiveness and efficiency of the participation of undergraduates in the scientific work of higher educational institutions.

#### IV. The Economics, Forecasting and Planning of Higher and Secondary Specialized Education

##### 1. The elaboration and improvement of the methods of the forecasting and planning of higher and secondary specialized education:

The improvement of the methods of determining the need for specialists.

The elaboration of methods of the forecasting and planning of the training of specialists (admission, the student body and graduation).

The elaboration of methods of the efficient distribution of the training of specialists over the territory of the country.

The study of the questions of the assignment and use of graduates.

##### 2. The formation of the manpower and financial resources and the material and technical base of higher and secondary specialized educational institutions and the increase of the efficiency of their use:

The planning, scientific organization and stimulation of the labor of professors and instructors, scientific and auxiliary educational personnel.

The improvement of the standard base of the management of the manpower resources of the higher school.

The improvement of the standardization of the expenditures on the maintenance of higher and secondary specialized educational institutions.

The increase of the effectiveness of the use of financial resources in the system of higher education.

The study of the processes of the management of the development of the material and technical base of higher educational institutions.

##### 3. The problems of education in light of socioeconomic and scientific and technical progress:

The determination of the trends and the elaboration of the principles of the improvement of the organization and the development of the system of education in its interconnection with the sectors of the national economy of mature socialist society.

The analysis of the socioeconomic effectiveness of higher and secondary specialized education.

The study of the historical laws and methodological aspects and the elaboration of concepts, prospects and forecasts of the development of the system of education in the country.

The trend of development of the system of higher and secondary specialized education in foreign countries.

The training of national staffs of specialists for foreign countries.

## V. The Management of the Higher and Secondary Specialized School

### 1. The procedural principles of the management of the higher and secondary specialized school:

The development of advanced methods of the management of higher and secondary specialized educational institutions.

The improvement of the organizational structure of higher and secondary specialized educational institutions.

The study of the influence of social and scientific and technical progress on the structure of the higher and secondary specialized school.

The improvement of the system of the training and increase of the skills of instructors and scientists.

Legal regulation at the higher and secondary specialized school.

The elaboration of the scientific principles of the state inspection of higher educational institutions.

### 2. Automated systems of the management of the higher and secondary specialized school:

The improvement of the methods of the automated management of the activity of the subdivisions of the USSR Ministry of Higher and Secondary Specialized Education and the ministries of higher and secondary specialized education of the union republics with the use of computer technology.

The study and development of optimization models of the management of the higher and secondary specialized educational institution.

The improvement and development of the software of the systems of management.

The development of the automated system of scientific and technical information on problems of the higher school.

### 3. The system of scientific and technical information at the higher school:

The elaboration of procedural and standardized materials on the organization of information activity in the system of the higher school.

The development of means and methods of the analysis and generalization of information on the advanced know-how of the higher and secondary specialized school.

## VI. Computer Technology at the Higher, Secondary Specialized and General Educational Schools

### 1. The increase of the efficiency of the use of computers:

The study and elaboration of methods of increasing the efficiency of the use of computer and microprocessor technology at the higher, secondary specialized and general educational schools.

The study and development of the standard base of the supply of the educational process with means of computer and microprocessor technology.

The study and development of promising collective-use computer systems and networks.

The study and development of new forms and methods of improving the content of the training of specialists and instructors in the area of the use of computers and microprocessor technology.

### 2. Automated teaching systems:

The development of software for automated teaching systems.

The development of automated teaching courses.

The study of the effectiveness of automated instruction.

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## TRAINING AND EDUCATION

### PROGRESS, PLANS OF NEW MOSCOW LASER INSTITUTE DESCRIBED

Moscow PRAVDA in Russian 30 May 85 p 6

[Article by V. Yevseyev from Moscow Oblast: "The Laser Center"]

[Text] We need dependable, economic and convenient-to-operate industrial lasers. For their development the USSR Academy of Sciences has organized a scientific research center. In addition to scientific research subdivisions, it also includes a design bureau and an experimental plant with base laboratories at various industrial enterprises.

Today it is widely known how very promising and productive is "light amplification by stimulated emission of radiation" (this is how the English phrase is translated from the initial letters of which the word "laser" is formed). It is also rather widely known that a laser can cut, drill, weld super-hard alloys and cut out fabrics, indicate the route for aircraft and etch parts, probe the moon and participate in the most delicate surgical operation.... What other amazing professions can be listed for the quantum light generators?

I was waiting for hints from the person with whom I was speaking. The Director of the Scientific Research Center for Industrial Lasers under the USSR Academy of Sciences [NITsTLAN], G. Abilsiitov, smiled:

"At one time a hatchet was considered a miracle of technology. Just think: it could cut through a log. Later on, smart fellows appeared who were capable not only of making the chips fly but could also cut patterns with a hatchet. The laser is the same hatchet, only a modern one. If you increase the energy densities in the focus it will cut and if you focus it differently, then an invisible hatching will be cut on the surface. Generally speaking, a laser has many professions."

"The end product of the NITsTLAN will be not only development but also finished products? That is, the path from the idea to the article will lie within a single institution?"

"Our center will be capable of not only developing but also under factory conditions manufacturing an experimental-industrial batch of lasers, 'work them up' under industrial conditions and then turn them over to industry for determining the run. In addition, we are responsible for coordinating the research and



development being carried out in the nation in the area of laser equipment and technology for the national economy. This is a very complex and many-sided task. Certainly diverse production processes can be carried out by the same laser. Precisely the universality and high productivity of a laser make it possible to employ it immediately in several production positions and operations."

The scientists and specialists from the NITsTLAN are already engaged in developing laser systems which together with traditional metal-working equipment, including robotized manufacturing centers, can accelerate the solution to an important problem, that is, creating flexibly adjustable automated processes. The effectiveness of laser equipment in such an association increases by scores of times. All of this provides an opportunity to say with certainty that the quantum light generators will become one of the most popular instruments of the 21st Century.

The experimental models of laser equipment which will be turned over to industry for series production should be born here, at Shatura, where we were talking with the director of the NITsTLAN. For now the scientific and production subdivisions of the center are scattered over various places in Moscow and the Greater Moscow Area.

The design of the Shatura center has been carried out by GiproNII [All-Union State Design and Scientific Research Institute for the Designing of Scientific Research Institutes, Laboratories and Scientific Centers of the USSR Academy of Sciences and the Union Republic Academies of Sciences] of the USSR Academy of Sciences. Construction is being carried out by the Mosenergostroy [Moscow Power Construction] Trust of the USSR Ministry of Power. The first stage, the laboratory-testing unit, is already in use. For this reason at the site, along with construction workers, one can encounter physicists, testers and adjusters.... At present, a great deal in Shatura depends upon the construction workers.

Behind the large panes of glass of the laboratory building which reflect the silhouettes of the construction cranes and sparks of electric welding, the daily routine of scientists is underway. Here they are finishing and testing Soviet-made laser units the first of which should be born at Shatura this year.

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AUTOMATION AND INFORMATION POLICY

UDC 658.562.018:519.2:006.065

EVALUATION OF QUALITY OF TECHNICAL DECISIONS IN DESIGNING

Moscow STANDARTY I KACHESTVO in Russian No 3, Mar 85 pp 53-55

[Article by A. V. Bazhenov, Mari Polytechnical Institute imeni A. M. Gor'kiy: "The Method of the Expert Evaluation of the Quality of Technical Decisions in Designing"]

[Text] The identification of the possible versions of decisions and the making of an analysis of the design features of these versions are envisaged at the initial stages of the designing of objects of technology (the elaboration of the technical proposal and the conceptual design). Here various information retrieval systems, as well as automated systems of the synthesis and selection of technical decisions (ASSVTR) [1] are being used more and more extensively. The latter are intended for the solution of such problems as the synthesis of feasible technical decisions on a given technical assignment (TZ), the checking of the possibility of realizing the technical assignment in the available information file, the synthesis of the decisions, which contain the desired structural components, the search for analogues, the minimization of the amount of modifications of known technical decisions and others.

The use of automated systems of the synthesis and selection of technical decisions at the initial stages of development makes it possible to control the quality of the items being developed and to shorten the time of designing. The effectiveness of these systems is directly dependent on the content and the methods of the formation of the information file of technical decisions, as well as on the models of the evaluation of their quality.

The experience of the development and use of the first automated systems of the synthesis and selection of technical decisions shows that substantial importance in the formation of the information file and the models of evaluation is attached to the methods of the obtaining and subsequent processing of expert information, which take into account the features of the stages of the development and use of the systems. The description of one such system, which makes it possible in case of the use of highly skilled specialists who are experts to increase substantially the reliability of the information in the file, to decrease the labor intensiveness of its formation and to increase the quality of both the information file itself and the model of the evaluation of the quality of technical decisions, is cited below.

When constructing automated systems of the synthesis and selection of technical decisions the basic difficulty of the formation of the information file and the model of the evaluation of the quality of technical decisions stems from the significant amount of information on the class of objects, which is being designed. Therefore, the need arises for methods of expert evaluation, which would be suitable for the analysis of a significant amount of information and at the same time would not be too labor-intensive (here and below by the labor intensiveness of the methods there are meant the labor expenditures, which are measured in man-hours, on the gathering, processing and determination of the compatibility of the expert information).

The most obvious means of decreasing the labor intensiveness are the decrease of the amount of initial information on the class of objects, which is being designed, and the increase of the skills of the members of the expert and working groups. However, both of these directions have a number of shortcomings, which make them unacceptable when developing automated systems of the synthesis and selection of technical decisions. Thus, in case of a decrease of the amount of initial information on the class of objects, which is being designed, not all the original, efficient and promising decisions will be examined, that is, the initial information being examined will not be representative with respect to the class of objects, which is being designed.

As to the second direction, as practical experience shows, for each organization, which is carrying out the development of automated systems of the synthesis and selection of technical decisions, there are restrictions on the qualitative composition of the experts who can be enlisted in development.

The methods of expert evaluation presume the presentation of the entire set of objects (technical decisions, documents and so forth) to all the members of the expert group for analysis and the giving of opinions. This circumstance is also the basic source of the significant labor intensiveness of the expert methods. Therefore, the aspiration to develop such a method, which would enable each expert to analyze only a portion of the basic set of information on the class of objects, which is being designed, on the condition that as a whole the parts being analyzed encompass all the information to be analyzed, is natural. But since such a method of expert evaluation is not, strictly speaking, collective, it is necessary to introduce the following condition: the results of the solution of the problems of the formation of the information file and the model of the evaluation of quality should not be worse (or not significantly worse) than the results which can be obtained in case of the use of collective methods of expert evaluation.

The fulfillment of the indicated condition is possible in the situation when each expert has the "cumulative" experience and knowledge of all the members of the expert group. This circumstance presumes the need to include in the composition of the operations of expert evaluation operations of the training of the experts, by means of which the "cumulative" experience is formed and the equalization of their information (knowledge) takes place.

Let us examine the method of the expert evaluation of the quality of technical decisions (TR), which, in our opinion, has a lower labor intensiveness. The proposed method envisages:

### Preliminary Operations

1. The determination of the goal of the evaluation.
2. The formation of the working group.

### Operations Performed by the Working Group

3. The determination of the basic sources of the gathering of information on technical decisions, as well as the determination of the number of their versions (N).
4. The determination of the average statistical number of technical decisions, which belong to the initial set, about which in a fixed period of time one expert can express his opinions (NTPC).
5. The determination of the number of members of the expert group.
6. The choice of the methods, techniques and procedures of the evaluation.
7. The determination of the list of operations which are performed by the experts.
8. The formation of the expert group.
9. The choice of the methods, techniques and procedures of the surveying of the experts.
10. The breakdown of the initial set of information on the technical decisions ( $\eta$ ) into  $n+1$  subsets:

$$\eta = \bigcup_{i=0}^n \eta_i, \eta_i \cap \eta_j = \emptyset \text{ for } i \neq j.$$

11. The conducting of the survey of experts.

### Operations of the Training of Members of the Expert Group

12. The identification by the members of the expert group of the most original, effective and promising technical decisions, which belong to the subset  $\eta_0 \subset \eta$ .
13. The decomposition of the technical decisions, which belong to  $\eta_0$ , into elements and characteristics [2].
14. The determination of the values of the individual indicators of the quality of the elements and characteristics of the technical decisions which belong to  $\eta_0$ .
15. The analysis of the results and the preparation of a decision on the readiness of the members of the expert group for the expert evaluation of the information on the class of objects, which is being designed.



### Operations of the Work of Each Member of the Expert Group

16. The determination of the most original, effective and promising technical decisions, which belong to the subset  $\tau_i$ ,  $i = 1, n$  (the expert works only with the subset  $\tau_i$ ).

17. The carrying out of the decomposition of the technical decisions, which belong to  $\tau_i$ , into elements and characteristics, as well as the construction of a tree of technical decisions of the "AND-OR" type [1].

18. The determination of the value of the individual indicators of the elements and characteristics of the technical decisions which belong to  $\tau_i$ .

### Concluding Operations

19. The elaboration of the expert evaluation:

1) only the technical decisions belonging to  $\tau_i$ , for which the values of the criteria of effectiveness, promise and originality are greater than some critical value  $g_j^*$  ( $g_j^*$  is defined by the expert method), are included in the information file of the automated systems of the synthesis and choice of technical decisions;

2) the general tree of technical decisions (the "AND-OR" type) of the class of objects, which is being designed, is constructed only in accordance with the decisions which have been included in the information file;

3) the model of the evaluation of the quality of technical decisions is constructed only in accordance with the data of the evaluations of the technical decisions which belong to the information file.

20. The analysis of the results and the preparation of the decision of the expert group.

Let us examine the peculiarities of the operations of the proposed method of expert evaluation (the operations of the expert evaluation of information on the class of objects being designed, which are identical to the operations in case of the expert evaluation of product quality, will not be examined, since they have been studied adequately and are fulfilled in conformity with All-Union State Standard 23554.0-79, All-Union State Standard 23554.1-79 and All-Union State Standard 23554.2-81).

Operation 3. Patents, certificates on inventions, catalogues, the results of tests and other scientific and technical literature are the sources of information on the class of objects, which is being designed. The methods of retrieving technical decisions in the indicated sources have been developed quite well and are well known [3]. The determination of the amount of information on the versions of technical decisions is carried out on the basis of the analysis of the system of notation of technical decisions in the indicated sources, for example, this can be a group of indices for a set of patents which contain a description of the technical decisions of objects of the given class.

Operation 4. The determination of the average statistical number of versions of technical decisions, about which in a fixed period of time  $T$  one expert can express his opinions, is carried out in accordance with the algorithm, a description of which is given in [4]. Here without reason let us assume that  $N_{TPC} = 49$ .

Operation 10. The initial set of information on technical decisions of the class of objects being designed  $\eta$ , which was determined as a result of the performance of operation 3, is broken down arbitrarily into  $n+1$  subsets of  $\eta_i$  (for simplicity we will assume that each such subset was formed by random).

The instruction of the members of the expert group in evaluation operations 12-14 on the basis of the example of the technical decisions belonging to  $\eta_0$  is carried out for the purpose of ensuring the unity of the approach of the experts to the evaluation of technical decisions when performing operations 16-18.

Operation 12. The subset  $\eta_0$  is presented to  $n$  experts for the purpose of ranking the technical decisions with respect to the complex indicator  $U = f(p_1, \dots, p_m)$ , where  $p_i$ , ( $i = 1, m$ ) are individual indicators of the quality of the technical decisions. If the dependence of  $U$  on  $p_i$  is unknown, the ranking of the technical decisions, which are included in the subset, is carried out with respect to each indicator  $p_i$ , while the overall rank of the technical decisions in accordance with all the indicators is obtained on the basis of the procedure of "the sum of the ranks" [5, 6].

The generalized ranking of the technical decisions, which are included in  $\eta_0$ , is obtained on the basis of the individual rankings which were received from  $n$  experts by the procedure of "the sum of the ranks," on the condition that the agreement of the expert rankings is within permissible limits.

Having obtained the generalized ranking of the technical decisions which are included in  $\eta_0$ , it is necessary to determine which of the given technical decisions should with respect to the adopted criteria (originality, effectiveness, promise) be included in the information file, and which should be discarded. For this purpose a certain number of gradations are matched with each criterion and their qualitative description is given. Let us designate by  $g_j$  the gradations of the criteria, where  $j = 1, 3$  is the numbers of the criteria, while  $i$  is the number of gradations of criterion  $j$ . It is necessary to find the critical gradations of the criteria  $g_{ij}^*$ , that is, such gradations, starting with which the technical decisions, which are included in  $\eta_0$ , satisfy the requirements of the formation of the information file of the automated systems of the synthesis and selection of technical decisions.

The critical gradations for each criterion are determined in the following manner:

$n$  experts suggest a set of gradations of the criterion and give their qualitative description;

the characteristic of agreement  $\beta_r$  is calculated for each gradation, which has been included if only by one expert in the set:

$$\beta_r = \frac{m_r}{n},$$

where  $m_r$  is the number of experts, who included the gradation in the set;  $n$  is the total number of experts. Gradations, for which  $\beta_r \geq \beta_0^1$  ( $\beta_0^1$  is determined by the expert method), are included in the set;

among the set of gradations of criterion  $j$  each expert determines the critical gradation, that is, such a gradation that the technical decisions, which correspond to the gradations lying belong  $g_*$ , cannot be included in the information file;

the characteristic of agreement is calculated for the determination of the agreement with respect to the choice of  $g_*$

$$\beta_{g_1}^j = \frac{m(g_1^j)}{n},$$

where  $m(g_1^j)$  is the number of experts who specified as critical gradation 1 of criterion  $j$ .

Let us take as critical the gradation of criterion  $j$ , which satisfies the condition:

$$g_*^j = g_1^j, \text{ if } \max_1 \{\beta_{g_1}^j\} \geq \beta_0^2$$

( $\beta_0^2$  is chosen by the expert method).

Operation 13. The agreement of the individual decompositions of the technical decisions (the proximity of the opinions of the experts with respect to the composition of the elements and their characteristics) is determined for each technical decisions which is included in  $\pi_0$ .

There serves as the measure of agreement the characteristic

$$\beta(\text{element} + \text{characteristics}) = \frac{m(\text{element} + \text{characteristics})}{n},$$

where  $m(\text{element} + \text{characteristics})$  is the number of experts who distinguished when decomposing the technical decisions this element with its set of characteristics.

All the elements and their characteristics, for which  $\beta(\text{element} + \text{characteristics}) \geq \beta_0^3$ , are the result of the decomposition of the technical decisions. The choice of the value of  $\beta_0^3$  is made by the expert method.

A tree of technical decisions of the "AND-OR" type is formed from the technical decisions which belong to the information file. The essence of the formation of this tree reduces to the following [2]:

the trees of technical decisions (graphs of the "AND-OR" type) are analyzed from the point of view of the distinction of identical structural elements and their characteristics;

the individual trees are combined in accordance with the common elements and characteristics into one common tree for an entire class of objects. The peaks of the "OR," which characterize the branchings of the technical decisions according to the alternate elements and their characteristics, appear here.

Operation 14. The determination of the values of the individual indicators of the quality of the technical decisions is carried out in accordance with [6]. However, the problem of constructing a model of the evaluation of the quality of technical decisions requires, in addition to the obtaining of the values of the indicator of the technical decisions, that the values of the indicators of its elements and characteristics be given. With respect to the set of indicators of the quality of technical decisions (for example, the indicators of the weight, reliability, number of standard components and so forth) this problem is solved relatively simply, since the value of the indicator of the quality of technical decisions is obtained by the convolution (sum, product) of their values.

In instances when such an approach is complicated, it is necessary to use the hypothesis that the value of the indicator of the quality of technical decisions depends on the value of the indicators of the element which is the "bottleneck" of the technical decisions. For example, for the technical decisions, which belong to the class of objects "transport plane," in the majority of cases the engine is the "bottleneck."

Among the elements like the "bottleneck" are the elements of technical decisions, for which there is met the condition:

$$\beta(\alpha_1) = \frac{m(\alpha_1)}{n} \geq \beta_0^4,$$

where  $n$  is the number of experts who are analyzing the technical decisions in accordance with the given set of individual indicators of quality;

$m(\alpha_1)$  is the number of experts who believe that for the given technical decision the element  $\alpha_1$  is the "bottleneck";

$\beta_0^4$  is a value which is determined by the expert method.

Operation 15. The generalized opinions of the expert group and the values of the parameters of agreement of the opinions of the individual experts are reported to all the experts. The experts discuss the obtained data, and in case of the elimination of the differences between them the working group presumes that the process of their training has been completed: each member of the expert group is prepared for the independent analysis of the subset of technical decisions  $\tau_1$ .



Operation 16. Each expert  $i$  ranks the technical decisions, which are included in  $\eta_i$ , with respect to the individual indicators of quality  $p_i$  or the complex indicator  $U = f(p_1, \dots, p_m)$ . Expert  $i$  includes in the information file of the automated systems of the synthesis and selection of technical decisions the technical decisions from the obtained ranking, to which the gradations of the criteria of effectiveness, promise and originality greater than the critical gradation, which is determined at the stage of the training of the expert group, corresponds.

Operation 17. The decomposition of the technical decisions, which belong to the information file, is carried out and a common tree of technical decisions of the "AND-OR" type is constructed.

Operation 18. The values of the individual indicators of the elements and characteristics of the technical decisions, which are included in the information file, are determined.

Operation 19. The technical decisions, which belong to  $\eta_i$  and for which the condition formulated when performing operation 16 is satisfied, are included in the information file of the automated systems of the synthesis and selection of technical decisions. The common tree of technical decisions of the "AND-OR" type of the class of objects, which is being designed, is obtained by combining the partial trees which were constructed for each subset  $\eta_i$ ,  $i = 0, n$ .

The model of the evaluation of the quality of technical decisions is constructed in accordance with the set of values of the indicators of quality  $p_i$  of the elements and characteristics of the technical decisions.

The calculations show that the labor intensiveness of the proposed method is approximately half as great as the traditional method.

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7807

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AUTOMATION AND INFORMATION POLICY

ACADEMICIAN FROLOV REVIEWS FUTURE USE OF ROBOTS, AUTOMATED PLANTS

Moscow NEDELYA in Russian No 16, 15-21 Apr 85 pp 2-3

[Interview with Academician K. V. Frolov, vice president of the USSR Academy of Sciences and director of the Machine Sciences Institute imeni A. A. Blagonravov of the USSR Academy of Sciences, by I. Usvitskiy: "The Pace of Progress"; date and place of interview not given]

[Text] Industrial robots, flexible automated production.... Certainly no one now must be persuaded how essential they are for modern production. However, there are still many difficulties on this path.

Why is this the case? There are many reasons. Let us endeavor to analyze certain of them.

[Question] Konstantin Vasil'yevich [Frolov], could you not first sketch in the picture which has developed in our country with flexible automated production (FAP)? What specifically has already been achieved now?

[Answer] A great deal. The nation's plants now have more than 12,000 robots in operation and these have passed a major exam under production conditions. There are also FAP sections in operation where, aside from all else, standard plans are being developed which are suitable for duplication on a nation-wide scale.

The first robots caused universal excitement as they seemed omnipotent. But when the wave of excitement had somewhat abated, the underwater rocks became apparent. And rather major ones, you know. But they also indicate those areas of research on which we must concentrate first.

Imagine an operating robot. Some energy is required by the electronics controlling it, some by the engines, the drive and so forth. But actually its useful work is the mechanical movement of a part. Seemingly it would be a simple question of in such an instance what is the efficiency of the robot? It turns out to be very low. Because in assembly, for example, in instrument building the robot moves a small part weighing several grams while here it "consumes" a good deal of energy.

At our institute, in the laboratory led by A. I. Korendyasev, a so-called cyclical robot has been developed. It operates according to a pendulum principle. In one cycle it stores energy and in the other consumes it. As a result energy consumption is reduced by 10-fold while speed is increased by 2-3-fold. In truth, a cyclical robot can perform only the simplest operations such as taking a part from here and delivering it there. But in industry the need for such robots is approximately three-quarters of the total number. A cyclical robot was developed by us for the first time in the world. As yet there are none of these abroad.

But here we have a problem. When a lathe operator turns one or another part, in the process of work he is constantly making the necessary measurements. But in flexible automated production, the work pace is such that not much can be measured by hand as a special system is needed. We are also developing such measuring robots. In the laboratory led by V. A. Chudov, they have equipped the serially-produced Finnish Nokia robot with a measuring head. We demonstrated this model at the "Metal-Working-84" exhibit. The design has turned out to be so successful that literally a week later representatives of the firm came to us with a proposal to organize joint production of such measuring robots.

A very important problem is equipment for industrial diagnostics. Take a motor vehicle. It comes equipped with an entire range of simple diagnostic devices such as indicators of water temperature, oil pressure and battery charge. But until recently robots have not had such equipment, although they are much more complicated than a motor vehicle. We are at work on this. And we are developing a diagnostics which not only indicates where the malfunction is, when the robot has already failed, but also makes it possible to predict the probability of the failure of one or another assembly. Similar to how a position can detect an approaching heart attack from a cardiogram and prevent it. The failure of one robot or one machine can lead to the shutting down of an entire section or even all production. For this reason the main demand upon such equipment is absolute reliability. Hence the importance of forecasting diagnostics.

Much work is being done in the area of intrashop transport. The old, traditional system involved an enormous overhead crane with a load capacity of some 50 tons which moved both parts and finished products about the shop. This giant would carry a box with parts weighing 10 kg through the entire shop or would move about without any load or even stand idle a half day. In the FAP the entire section or the entire shop is permeated by the transport system, the transport robot carts deliver stock from the warehouse, move machined parts and deliver a new tool in the place of a broken one. And all of this is done according to optimum routes with not even an extra meter. In the development of robot carts there have been great advances in our country as well as in the CEMA countries, particularly Bulgaria. But here the main thing is the control system which sets the routes.

This same control system also solves the main problem of ensuring the highest workload for the equipment. Certainly the FAP costs, as you realize, a good deal of money and hence the return should be appropriate, otherwise all automation become economically disadvantageous. And for this, I would like to emphasize, there must be a new, higher level of production organization so that the equipment is not only fully but also rhythmically loaded.



[Question] Konstantin Vasil'yevich, understandably in such an enormous undertaking not everything will go smoothly. Obviously difficulties arise not only in the design bureaus.

[Answer] How true! First of all there is the creation of prototypes. A robot is such a complicated device that it can scarcely be made not only "on your lap," as they say, but even at a traditional experimental facility under a scientific research institute. Hence, we must turn to the plants. And here it starts: our designers concerned with research on robot mechanics and their software are forced to agree on everything down to the last...bearing. And this takes years! And here is what happens. Several years ago, we developed a new robot. While the mock-up was being made, while, roughly speaking, those bearings were being approved, 3 years passed. During this time foreign firms were already producing series models although we were ahead of them at the start of the work.

The main root of the evil is that we are not behind in ideas or the promise of our concepts, we lag behind in realization.

Another misfortune is in the insufficient coordination in the work of all the scientific research institutes and design bureaus engaged in robot engineering. The production processes are sufficiently standard and it would not be hard to reduce them to several score program modules. Incidentally, the diversity in the software, that is, in the programs controlling the robots, is a major problem. Virtually every scientific center works out its own programs and own languages. There must be a standardization of the modules from the viewpoint of language. This is a very major problem which must be solved by both the scientists and the USSR Gosstandart [State Committee for Standardization]. Otherwise each time we will "reinvent the bicycle." If we have standard program "building blocks," then the process of developing any specific FAP will be shortened by several times.

A very painful question is the reliability of the computer equipment employed in the FAP. We need special computers adapted for production conditions.

The plants of the future are humanless or unmanned production. We will reach this in 20-25 years. For now, the flexible automated systems and robots are arriving in the usual, even largely modern plant. What happens? The design and production specifications are done by hand as before for such an "intelligent" system and the monthly and daily plans are compiled also by hand. As they say, on the one hand you have the 20th Century and on the other.... The way out is in automating not only the work of the worker but also the work of the designer and production engineer. The establishing of a unified, automated plant where the designer and the production engineer work in a dialogue with a computer--this is the most promising task. In such production blueprints will not be needed. What happens now? The designer works out the specifications, the copier makes a copy, the production engineer draws up the flow sheets, the foreman receives a drawing and studies it and turns over the drawing to the worker. You can see just how much time is spent listing all of this, and I even left out a good deal in this simple chain. At an automated plant, the information from the designer's desk, in running through the system of production preparation, can be transmitted directly to the computer controlling the FAP.

As you can see, we are confronted with a task of enormous scale.

[Question] The robot or FAP has been developed, the software exists for them and the time has come for introduction. But here....

[Answer] Here there are also problems, and very complex ones. In the first place, not everyone wants to introduce the innovation. The leader of a well-operating plant is content with it as it is. In his hands is production, although not very flexible or very automated, but still operating, fulfilling the plan and bringing profits and bonuses. Sometimes the suppliers and cooperating firms fail him and sometimes even his own employees. He is used to dealing with this problem and knows how to avoid all unpleasantnesses. He creates reserves of materials and reserves of time. But if anFAP were introduced at his enterprise, a portion of the personnel would have to be shifted to another job and some would leave themselves. The wage fund would decline and deductions for social requirements would decline. Most importantly, the FAP would require a completely different level of delivery discipline and an even pace without any rush work at the end of the month or year. For this reason, the attitude of many leaders is: "We, of course, are in favor but...let us wait a little and see what happens with the others...."

In truth, fortunately, there are other leaders of a new sort, enthusiasts who do not live merely for today but are also able to look ahead and are interested in introducing the robots and FAP. For example, we are very content with our collaboration with the ZIL [Automotive Plant imeni Likhachev], with the Dinamo Plant and Krasnyy Proletariy which should become the prototype of the future plant and a testing range for new developments under the conditions of real production. Our institute is developing a diagnostic center for Krasnyy Proletariy, it is working on the laser strengthening of materials and is working out general concepts for a maximum production load. This will be a large-scale, real experiment in industry and this is particularly important for now.

Not so long ago I was in Moldavia, in Tiraspol, at a plant where a group of young engineers had developed a fully automated section in an assembly shop. The robots worked rhythmically, smoothly and precisely. Unfortunately, as yet there are few such examples but they are very persuasive.

For extensive introduction we must also have proper economic levers which make it advantageous to employ the robots and FAP as well as everything new in general. Here we fully share the viewpoint of Valeriy Leonidovich Makarov, the director of the Scientific-Research Institute for Organization and Management who quite recently spoke about this in your weekly (No 5, 1985). It is essentially to plan for the time over which automated production can be developed and established at an operating enterprise, even at the expense of a temporary reduction in the volume of produced product. A well operating FAP will more than pay for itself.

On our behalf we are also endeavoring to accelerate the introduction process. At the end of the year, we began holding sessions of the scientific council inviting in industrial representatives. This is a new form when it is not the scientists who report to the council, but rather the scientific council which reports to industry, and this is a form which promises to be very effective.

The time is not far off when robots and FAP will be widely introduced and the scientists from many specialties and production leaders should be prepared for this.

There is also a whole series of social questions which must be studied even now. For example, take the problem of physical stress at a plant of the future. The workers will work in front of a display, with a computer or with a robot. They will work not so much with their hands as with their eyes and brain. What should be the length of the work day for them, when and how many breaks should there be? Should they work 3 hours, 5 hours or 8, with a break every hour? How should labor be paid? At present we do not know this. And we should as the price of an error by each worker on the job in the future will rise by many fold.

Still all the listed scientific problems do not ensure a real return from automated production if we do not solve the two main ones, I would call them super-problems....

The first is to ensure exceptional labor discipline. The plan of the future is labor requiring intelligence, the highest organization and discipline, as negligence on the part of a single worker at a control panel can lead to the halting of the entire enterprise or even an emergency.

Discipline and organization are essential not only for those working at the given plant but also for their cooperating enterprises. Flexible production lines will exchange parts and assemblies, receive raw materials and dispatch finished products to the consumers. But you cannot explain to a robot that a combine manufacturing, for example, rolled aluminum has not met the monthly quota. The control computer will not accept "objective" factors due to which the railroad did not supply on time cars for the finished products. All industry, transport and communications should endeavor to equal automated production. This is a new level of planning and management, discipline and organization in production.

[Question] Konstantin Vasil'yevich, you said that in 20 years there will be many such plants, an entire network and hence, the workers for them are already born and in another year or two they will be going to school. They must also be taught in a new manner.

[Answer] This is the second main problem as we need a new type of worker and engineer who is capable of productive intellectual labor. Knowledge is becoming the main lever of production and an actual material value.

A metal-working machine or internal combustion engine is studied everywhere in our country, at school, at the PTU [vocational-technical school] and in the technical school. Each boy knows that in a motor vehicle there is combustion, a spark plug and a cooling system. A robot is more complicated and at present nowhere are we studying it. The new type of specialist must be trained from childhood and the sooner the better. He should have programmable electronic toys and even in the nursery he could play with robots as he presently plays with toy motor vehicles. The play process subconsciously develops in the child a mathematical or programmer type of thinking. In this play he should learn



not to lose information, to correct mistakes, he should believe that the computer controls the plant and has an approximate idea of how it does this.

Even more difficult tasks confront the school. You know that these tasks have been discussed and are presently being discussed at the highest level. Quite recently the Politburo of the CPSU Central Committee outlined the measures to ensure computer literacy of secondary school students and to widely introduce computer equipment into the educational process.

Finally, there is higher education. The prewar education could be termed "reference," that is, a supply of knowledge gained in the VUZ was sufficiently great and did not require updating for a score of more years. At present, education more and more often is called "scientific" and it is essential to instill both the ability and the need to constantly update one's knowledge. Not everyone can do this.

Let us take a look at what we have. The competitions to the technical VUZes are dropped and an alternative arises: either fulfill the recruitment plans which is impossible without lowering the demands made upon the students or the maintaining of the demands on a high level and rigid selection both in admission and during studies. It is no secret that we are following the first path. As a result we are still producing many specialists who do not meet the needs of today.

A profound reform in higher education is a requirement of today. The VUZes should receive the right to expel mercilessly those who do not wish to study. At present, there is no other way to halt the rapid inflation of the engineer diploma.

Any course work, let alone a diploma project, should be carried out on the level of a major development and should not be a rote project for a "tick." Even in the third year, one should take a course of instruction at a base enterprise and be assigned for work at this enterprise. Generally speaking, it seems to me, the young people should be permitted to be involved in major and real undertakings and not keep them under "schoolboy" conditions.

I would particularly like to mention the prestige of the engineer which is now declining rapidly. We have the titles such as "Honored Artist," "People's Teacher" and so forth but there is no commendatory and socially significant title for an engineer. And certainly it was engineer labor or, as it was said previously, engineer art which created the designs of all the machines and articles surrounding us.

[Question] I see that you are looking at your watch.... Allow me a last question: we are coming to the end of the 20th Century and more and more frequently specialists are making forecasts for the third millenium. What would be your forecast in the area we are speaking of?

[Answer] Obviously, a new economic infrastructure will arise on a nation-wide scale. Not individual plants but rather entire sectors will be automated and, in looking wider, not only industry but also agriculture and transport. All the historic advantages of socialism will be realized on this basis. In living



under the conditions of an "electronic society," the new generation will be a generation of intellectual and intelligent persons who have mastered both technical and humanitarian knowledge.

I would also very much like to see a rebirth of the romance of engineer labor which is now creating this future.

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## INDUSTRIAL AND MILITARY APPLICATION

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### STANDARDIZATION IN SMALL-SERIES, CUSTOM PRODUCTION

Moscow STANDARTY I KACHESTVO in Russian No 3, Mar 85 pp 25-28

[Article by Section Chairman Doctor of Technical Sciences Professor A. L. Vasil'yev: "The Standardization of Assemblies and Parts in Small-Series and Custom Production"]

[Text] Representatives of 18 organizations of the machine building, transportation, construction and fuel and power sectors of the national economy took part in the work of the section. The basic composition of the participants is chief designers and management personnel of design and scientific research organizations, scientific industrial associations and higher educational institutions.

It is possible to arbitrarily break down all the reports and announcements, which were presented at the section, into two groups: those devoted to specific experience in the area of standardization and those which touch upon questions of an intersectorial nature.

In his report A. I. Shul'gin (Scientific Research Institute of Chemical Machine Building) told about the performance of work on standardization in the Ministry of Chemical and Petroleum Machine Building. The reference document, which was drawn up in the sector, makes it possible to establish a unified procedure of performing work on standardization. He, in particular, noted that many types of chemical equipment, in spite of the custom nature and small-series nature of their production, have a level of standardization of 70 percent and more. The best results have been achieved in the area of cryogenic machine building. The standardization of items, by promoting the organization of their specialized production, is enabling the sector to plan the increase of the proportion of the output which is produced by enterprises which are engaged in the manufacture of assemblies and parts.

Candidate of Technical Sciences A. V. Tropillo, chief of the Standardization Department (Central Scientific Research, Planning and Experimental Institute of Industrial Buildings and Structures), devoted his report to the problem of the ratio of the "conservative" and "flexible" approaches in architectural and construction standardization.

By the "conservative" approach to standardization the speaker understands the establishment for use of such a set of decisions, which is oriented in advance toward a relatively stable industrial base. In this case the possibilities of architectural decisions are limited.

Such an approach was implemented in architectural and construction standardization in the late 1950's and early 1960's, when mass housing and industrial construction was converted to industrial methods which were based on the plant production of prefabricated components. The extensive network of plants of reinforced concrete items and house building combines with a practically identical technology, which was developed in the country, served as the technical basis of the industrialization of construction. In housing construction the completely finished house was taken as the object of standardization. In industrial construction standardized spans, spacings and heights of columns, industrial types of single- and multiple-story buildings and a limited range of type sizes of components for plant production were established.

The "flexible" approach, in the opinion of the speaker, can be implemented in case of the establishment of a system of standardization, in which opportunities for the development of both the industrial base and architectural construction components are envisaged.

The "flexible" approach is a decisive requirement of the new stage of the industrialization of construction.

In contrast to the uniformity and relative stability of the industrial base and the output of construction at the preceding stage, the progressive development of construction technological processes of types of buildings and components is an expression of the new stage. Here along with the improvement of traditional systems, which are based on the use of precast reinforced concrete, fundamentally new, industrial systems based on the use of components made of metal, laminated wood and other efficient materials, which are delivered in sets, are being assimilated.

The methodological principles of the implementation of the "flexible" approach in architectural and construction standardization are being formulated by the institutes of the USSR State Committee for Construction Affairs.

The theme of the report of N. T. Yegorkin (Gipromashobogashcheniye) is "The Development of Promising Ranges of Items of Heavy and Transport Machine Building." By ranges, the speaker noted, one should understand a technically and economically sound set of items, which has been systematized by functional purpose and basic parameters with an indication of the models of items, their brief technical characteristics, the time of assimilation, the design organizations and the manufacturing plants.

The ranges are developed by the leading institutes (enterprises) for the basic types of attached items (as well as those being developed). The development and management of the ranges, as a rule, are carried out by the services which plan scientific research work and experimental design development.

The assignments on the development of a promising range, the speaker said, are included in the plans of economic and social development in the section "The Plan of Scientific Research and Experimental Design Operations for All-Union Industrial Associations, Production and Scientific Production Associations, Which Are Directly Subordinate to the Ministry."

The list of ranges in effect in the Ministry of Heavy and Transport Machine Building as of 1 January of the current year are sent annually to the ministries which are the users (purchasers) of items of the Ministry of Heavy and Transport Machine Building. The range is a mandatory document for the user enterprises and the manufacturing enterprises.

Further the speaker noted that the introduction of the range will make it possible to ensure the maximum standardization of the parts and assembly units of machines and will create favorable conditions for series output and production specialization.

Candidate of Technical Sciences V. S. Ugolev told about the experience of the standardization of equipment which is used in petroleum production.

The report of Candidate of Technical Sciences A. Z. Mayper, engineer A. A. Katanov and Doctor of Technical Sciences B. V. Popovskiy (All-Union Scientific Research Institute of Installation and Special Construction Work) was devoted to the optimization of the parametric series of vertical cylindrical oil storage tanks.

In the report an approximate solution of the problem of optimization, in which the estimated cost is taken as the criterion, while the "demand function" is defined by means of statistical methods of forecasting, which envisage the generalization of the known data on the output of storage tanks over a specific interval of time and the extrapolation of the found regularity onto the accounting year, was examined.

Further in the report it was noted that the set of possible parameters, from which various parametric series "are accumulated," is determined so that the design of the storage tank would be practicable in production and installation, would be efficient in the consumption of metal and would satisfy the requirements of the maximum standardization of the components.

The problem of optimization is being solved by the method of dynamic programming with the use of computers in conformity with "The Standard Method of the Optimization of the Simple Parametric Series" of the USSR State Committee for Standards.

The solution of the optimization problem showed that the results depend substantially on the type of demand function in the intervals between the known points which correspond to the parameters of the existing series of storage tanks.

The report of L. K. Ozol (Leningrad Central Planning and Design Bureau of the Ministry of the Maritime Fleet), which was devoted to the question of the



interconnection of the economics of standardization and the modular formation of equipment, was listened to with great interest.

The methodology of determining the components of the economic impact: from the increase of the uniformity of products, from the organization of specialized production, from the freeing of working capital and from the possible early commissioning of a ship, was shown on the basis of the example of functional modules of ship spaces (FMSP's).

A block diagram of the algorithm of the calculation and the formula for the determination of the components of the economic impact was presented.

Responding to questions, the speaker showed convincingly that the proposed method of the economic evaluation of the results of the modular formation of complex systems on the basis of standardization can also be used in other sectors of industry.

A lively and pointed report on the theme: "On Measures on the Improvement of the Practice of Intersectorial Standardization" was given by Candidate of Technical Sciences N. V. Zharkov (VNIPIgazdobycha). The speaker showed in a well-founded manner the need for the establishment of temporary scientific production laboratories (divisions) or working groups for the intersectorial standardization of objects which have priority in the development of the national economy, for example, objects of gas fields.

The technical administrations of the ministries which are the users (operators) should assume the basic role in the organization of such combined subdivisions, the speaker noted.

In the report it was particularly stressed that the search for the optimum level of standardization, for which the development of an information base (tables of applicability, restricting lists: calculations of the economic impact and other technical materials) is necessary, should serve as the starting point in the standardization of objects. Moreover, the optimum level of standardization should serve, in the opinion of the speaker, as an indicator, for the achievement of which the developers of objects should be stimulated from the assets of the specific all-union industrial associations, which are the clients and at which the impact from intersectorial standardization comes to light.

The publication by the State Committee for Standards of new standard technical materials on standardization, especially generally comprehensible methods on modular designing on the basis of computers, is of considerable importance for the development of intersectorial standardization, the speaker noted. In the opinion of the speaker, the promotion of theoretical and practical works on standardization lags behind the requirements of the times. The Ministry of Higher and Secondary Specialized Education also needs to revise the plans of the training of specialists in the area of the spreading of the teaching of the principles of standardization.

Further the speaker focused his attention on the role of unification and standardization in the increase of the quality of the technical operation of

objects. He, in particular, believes that the maintainability of objects should be indicated in the cards of the technical level in the form of a constant, by analogy with the power, lifting capacity, tractive force, speed and other characteristics. For this purpose the speaker proposed to carry out the standardization of systems of the maintenance and repair of every type (kind) of objects, on the basis of which the numerical value of the maintainability of each of them is to be regulated.

In the report of V. P. Sutyagin and M. L. Tabakman (Scientific Production Association of the Central Institute of Boiler Turbines imeni I. I. Polzunov) the questions of the accounting of components of items were examined and a method of determining the level of standardization in power machine building was presented.

For the streamlining of the accounting of the frequency of use of components of the items being produced, the speaker said, Guiding Technical Materials 108.002.23-83 "The Standardization of Items of Power Machine Building. The Accounting of the Frequency of Use and Systematization of Components of Items" was introduced at enterprises of the sector as of 1 January 1985. The establishment of the uniformity of accounting will facilitate the determination of the range of components of items, for which it is advisable to organize specialized production.

The second part of the report was devoted to the preliminary work on the determination of groups of comparable similar equipment and to the description of the necessary initial information for the calculation of the coefficient of the frequency of use and standardization.

N. M. Kolpakov (VNIIPTMASH) told about the work on the intersectorial standardization of hoisting cranes.

The speaker noted that the difference in the level of the technology and organization of production of the corresponding enterprises influences the difference of the cranes, which are produced by enterprises of different ministries. At the same time the machines being produced have common principles of operation and have common most important components. Among such components are: running wheels with axle boxes, balance beams, hook suspension members, control cabs and so on.

The similarity of the principles of operation is characterized by the similarity of the basic parameters--the lifting capacity, the speeds of movement of the devices. All this constitutes real prerequisites for intersectorial standardization.

At present, the speaker noted, the approval of two state standards, which encompass practically the entire range of hoisting cranes, was the most significant result with respect to intersectorial standardization in crane building. The approved standards create real prerequisites for the further development of the work on the achievement of unity in the designing of this type of equipment.

"The Construction of Optimum Parametric Series of Equipment Is the Basis of Production Specialization" is the theme of the report of V. P. Kotikov and Candidate of Technical Sciences V. K. Andrikanis (All-Union Scientific Research Institute of Standardization in Machine Building).

In the opinion of the authors, the development of parametric series for units for the finishing of rolled metal products as a whole is inadvisable owing to the custom nature of their production. The functional parts of units of various types (main, technological and tail) are recurrent and have a similar composition of machines and devices.

The multiplicity of units of the finishing of cold-rolled strip steel (about 40 types) required the formulation of a classification of such units on the basis of their functional purpose, which is determined by the characteristic technological operation.

In the report it was shown that the head parts of the units are most promising for standardization on the basis of parametric series.

The series of values of the main parameter is constructed on the basis of:

the extremes of the series, which establish the range of widths of the strips of 500-2,300 mm, which are obtained on strip mills;

the initial series of the range of widths of strips according to All-Union State Standard 19904-74.

The problem of constructing the optimum parametric series of the main parameter, as which the largest width of the strip of rolled stock was taken, was regarded as a problem of optimization according to the criterion of the adjusted expenditures on the production, transportation and consumption of metal products. With allowance made for the specific nature of the equipment the construction of parametric series of the machines and devices of the head parts is carried out on the basis of the parametric series of the main parameter of the head part with the use of the method of statistical decisions.

In the report it was also emphasized that the construction of optimum parametric series of the head parts of units and the machines and devices, which are included in them, and the subsequent standardization of these parameters and structural components will create the necessary prerequisites for the further expansion and intensification of specialization in the subsector of metallurgical machine building.

Candidate of Technical Sciences N. P. Lyubushin (Gorkiy Polytechnical Institute) in his report dwelt on the role of standardization in connection with the general policy of developing versatile production systems. The speaker noted that it is characteristic of the process of developing means of production that general-purpose equipment with the increase of the production volumes was replaced by specialized and special equipment. Here changes occurred both in the technology of manufacturing (from mechanization to automation) and in the organization of production (from single machines to



integrated lines). On the basis of the example of versatile production systems a return to the universalization of equipment is occurring, but on a qualitatively new basis: a high degree of automation of the equipment, which is combined into computer-controlled technological complexes.

The speaker emphasized that the versatility of equipment in combination with high productivity requires significant capital investments, which affects production efficiency. Therefore, it is expedient to analyze whether all the factors of the intensification of production on the basis of specialization were used.

They were obviously not (this was also spoken about in the reports of the plenary session).

The unsatisfactory utilization of lines of item specialization is explained, first of all, by the low level of intradesign and interdesign standardization, when assembly units, which are similar in functional purpose, are designed as original units. Not only the shortcomings in the organization of designing, but also the demands of scientific and technical progress on the increase of the diversity of the equipment being produced appear here.

The fulfillment of this requirement is possible through the designing of items, which consist of base parts and interchangeable blocks, the specific combination of which makes it possible to obtain items of the required functional purpose, that is, through the modular principle of the formation of items. The implementation of this principle should be carried out on the basis of the standardization of items of the same functional purpose.

Further the speaker noted that the satisfaction of the requirements of scientific and technical progress is possible only in combination: the creation of versatile production systems, which make it possible to combine high labor productivity with the diversity of items, and the development of the modular principle of the formation of equipment. The former direction requires along with the development of the theory of versatile production systems significant capital investments (the speaker particularly emphasized the word significant).

The latter direction--the development of the theory of the modular principle of the designing of equipment--requires the reorganization of the very process of designing. The available experience shows that the use of the modular principle in case of the designing and production of technical systems frees industry from significant additional capital investments. The speaker believes that one should change over to versatile production systems only after the use of all the possibilities of the intensification of production on the basis of standardization.

In the report of V. F. Polushkin and Candidate of Technical Sciences B. G. Garber (Kriogenmash Scientific Production Association) the experience of the organization of work on the regulation of the diversity of cryogenic equipment being produced, the items of which are typical representatives of custom and small-series production, was described.



By the early 1970's about 250,000 drawings, a portion of which repeated each other in design, were in production of the Kriogenmash Scientific Production Association. In the report it was particularly emphasized that any work on standardization in the absence of rapid information on the basis of a well-organized archive system after a short time (4-5 years) comes completely to naught, and the analysis of all the design documents is again necessary. Thus, drawings of standardized series of parts and assembly units existed at the scientific production association back in 1965. Upon the analysis of all the design documents in 1973 a large number of original design documents for practically the same parts and assembly units were found.

At the Kriogenmash Scientific Production Association the work on standardization is organized according to the following arrangement: classification--the standardization of equipment--the standardization of technological processes--the specialization of production--the mechanization and automation of production.

The author directed special attention to the importance of the standardization of technological processes under the conditions of custom and small-series production.

Impressive figures of the achieved decrease of the number of type sizes of equipment and the obtained impact were named.

In the report it was stressed that the development of modular items and of type size series, which are optimum according to the economic criterion, the improvement of the system of classification, the development of reference and retrieval indices for groups of parts, the limitation of the frequency of use--all this is a prerequisite of the extensive use of computers for the development of new versions of items of cryogenic engineering.

On the basis of the reports and statements it is possible to draw the following conclusions:

efficient coordinated activity on intersectorial standardization with respect to many types of equipment is lacking;

the elaboration of a well-balanced concept of the use of standardization as a method of regulating the structure of complex technical systems is necessary;

the theory of standardization and the methods of the evaluation of activity in the area of standardization, especially according to the economic criterion, require further development;

research in the area of the theory of the modular formation of technical systems, as one of the basic means of the regulation of equipment, and the study of the interconnection of standardization and the construction of equipment on the basis of the modular principle are needed.

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INDUSTRIAL AND MILITARY APPLICATIONS

POLYMER SPECIALIST INTERVIEWED ON NEW PRODUCTS, APPLICATIONS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 Apr 85 p 2

[Interview with Academician N. Yenikolopov by special correspondent N. Il'inskaya: "The Engineer Compass of Science"; date and place of interview not given]

[Text] Lenin Prize winner, Academician N. Yenikolopov, is the director of the Institute of Synthetic Polymer Materials of the USSR Academy of Sciences, the chairman of the Interdepartmental Council on Synthetic Materials Under the Presidium of the USSR Academy of Sciences and chairman of the Council for the Use of Polymers in the National Economy Under the State Committee for Science and Technology.

How to accelerate the introduction of results from academy science into practice and more quickly embody this in efficient production methods and progressive equipment? This today was the subject of the conversation of our special correspondent N. Il'inskaya and Academician N. Yenikolopov.

[Question] Nikolay Sergeyevich [Yenikolopov], your scientific discoveries have been the basis for 150 inventions. Virtually all of them are "at work" in the national economy. How do you combine your theoretical work with practice?

[Answer] Theory must anticipate the ways of practice and a lack of foresight by a scientist costs the state a great deal. At present, several score million chemical reactions are known. A study of the patterns under which they occur is science. But if we are not oriented at the practical benefit from this research, then there will be the classic case of "satisfying one's own curiosity at state expense." Only when technology becomes an organic part of research do scientific discoveries go straight into practice. When at the end of the 1960's the effect of "rupture chain transfer" was discovered, I immediately focused a group of co-workers on developing fundamentally new polymers based upon the discovered chemical regularities. In a short period of time many materials were synthesized with a diverse range of properties. Some replaced nonferrous metals in machine building while others went into space and still others dependably serve us in everyday life. It must be said that the discovery by science of previously unknown laws or phenomena of nature in and of itself provides new opportunities for practice which we previously did not even suspect.

[Question] The March Plenum of the CPSU Central Committee emphasized that we must achieve a decisive turn toward intensive development and within a short period of time reach the most advanced scientific and technical positions and the highest world level of social labor productivity. What steps should be undertaken by the academy of science for reaching these goals?

[Answer] First of all, it is essential to correctly apply scientific methods for practical purposes. What do I have in mind? Let me explain this from a specific example. Some time ago, chemistry was engulfed by gigantomania. Increased output of chemical products was linked to just an increase in the unit capacity of the reactors. To some degree this notion is indisputable as the higher the capacity of the unit the lower the specific capital investment and hence product cost. But only to a certain limit. Just recall the giant machines for producing polyethylene. When these were transported from the manufacturing plants, the roads, bridges and flatcars had to be specially strengthened.

But certainly the economic output of polymers can be achieved without resorting to gigantic equipment. Of course, a simpler increase in the volume of the units is simpler than the search for fundamentally new ideas. And here the human factor should go to work. The researcher must be able to exploit science as a shop with an unique set of tools for working out new technological ideas and applying them to the needs of industry.

This has been followed, for example, by scientists from the Institute of Chemical Physics Under the USSR Academy of Sciences. Thus, in utilizing the effect of a frontal thermal wave, they have been able to reduce by 200-fold the volume of the reactor for obtaining the same quantity of polyisobutylene or its copolymer, a raw material for synthetic oil and rubbers. The new production method did not remain in the laboratory but immediately spread to the plants. Scientific methods made it possible to increase by 6-fold the productivity of the reactor without increasing its volume for synthesizing such a valuable polymer as polystyrene. The process has become more economic and polymer quality has improved. As you can see, before our very eyes there has been a growing together of fundamental research and technology.

[Question] At the laboratory I tested "Yenikolopov bread." As I was told, as yet it has no other name. Here they explained that the bread has no equal in terms of diatetic value. In comparison with wheat bread it has 16 percent more protein, 65 percent more vitamins of the B and E group, 2-fold more mineral compounds of iron, phosphorus and potassium and 10-fold more cellulose. With existing technology all these valuable components contained in the grain hull are removed along with the bran which cannot be milled finely. And here you, the chemists, have proposed a method for grinding the entire grain along with the hull. Was this work done specially upon the request of the grain growers?

[Answer] No. Here we can see the universal property of technology as fundamental science. This is what happened. For carrying out one specific integrated program, it was necessary to develop progressive methods for grinding up polymers. Crushers were not usable for this, since the heat generated in the crushing softened the polymers and turned them into an elastic bulk like dough. Such a viscous mass could not be ground into powder, as it threw off the loads like an athlete's swing. Hence the temperature effect had to be excluded from the grinding process.

I will not go into detail on the essence of the research which led to the discovery of previously unknown regularities. I will merely mention the practical outcome: we found a new method for turning solid polymers into powdery ones in fractions of a second. This method provides an opportunity to reutilize each ton of produced oil.

[Question] How?

[Answer] Each year, our nation piles up more than a million tons of worn out tires, many thousands of tons of old rubber footwear, packaging material and conveyor belts. These "wastes" in terms of their chemical nature continue to remain a scarce raw material obtained from precious petroleum. One industrial pulverizing unit is capable of producing 3,000 tons of powder a year. The polymer meal is used for loading plastics, for industrial rubber goods and anticorrosion protection.

This is how the production method arrived at the door of the flour millers.

[Question] If you have succeeded in turning polymers and grain into powder then obviously the new method is capable of doing much else.

[Answer] Undoubtedly, if there were the desire of the appropriate ministries. For example, it would be possible to employ the new method for producing high-quality wood meal which could be produced by a simple energy-intensive method.

[Question] In your scientific creativity have there been instances when practice dictated the direction of your research?

[Answer] Medical workers turn to us with a request to "think up" a new material for heart valves which would be capable, like living tissue, of contracting and changing its elasticity in the process of work.

Or another order, this time from the machine builders. They needed a new structural material which possessed a definite range of properties. We considered this order in the plan of our research.

The engineer compass is useful to the researcher. Science is infinite in the chain of constantly arising problems. It is the duty of the scientists to help in carrying out the important task posed by the party and government, namely to provide a true about-face in accelerating scientific and technical progress and in increasing the effectiveness of the Soviet economy.

10272

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## PATENTS AND INVENTIONS

### DEVELOPMENT OF HIGH-PRECISION LASER CLOCK TRACED

Moscow PRAVDA in Russian 27 May 85 p 7

[Article by PRAVDA Correspondent Ye. Solomenko from Novosibirsk: "The Most Precise Time"]

[Text] Chebotayev had his own, special relationship with time. In eighth grade he began studying the VUZ textbooks on physics; as a young man he was firmly determined to become a scientist. But science is primarily knowledge and this means stubborn, daily work. At age 34, Chebotayev had become a doctor of physicomathematical sciences. At 43 he was a corresponding member of the USSR Academy of Sciences. Seemingly he had achieved the top but the awareness that it was still just the beginning did not leave.

The research which Veniamin Pavlovich [Chebotayev] conducts has underlain a new scientific area, laser spectroscopy and laser metrology. And everything started in 1961, when, due to the efforts of Chebotayev and another four dedicated researchers quickly, in less than a year, developed the first Soviet-made gas laser. Soon thereafter the informal group was turned into a laboratory and later into an independent section. At present, V. Chebotayev is the deputy director of the Thermophysics Institute of the Siberian Division of the USSR Academy of Sciences.

What is laser metrology? It is difficult to explain to a non-specialist the essence of an entire range of major fundamental research. It is easier to show its applied importance. In the course of their work Chebotayev and his colleagues set for themselves the task of developing the most precise clock in the world, an optical clock. First they developed the "pendulum" of such a clock, a stable laser which at that time did not exist in world science and technology. The scientists caused it to make a million billion oscillations a second and then "taught" it fantastic precision so that it would not err more than a second over 10 million years.

The work was based on new physical principles for the development of which V. Chebotayev was awarded the Lenin Prize in 1978. And 3 years later, in a small French town, Veniamin Pavlovich from the rostrum of an international symposium stated that Soviet researchers had developed the world's first optical clock.

Record-setting clocks which are beyond the imagination in terms of accuracy and stability are very important for near and distant space communications, for predicting earthquakes and for very complex experiments. In addition, this is an impetus for developing a single standard for time and length.

The life of Veniamin Chebotayev is work: the setting up of experiments, the working out and testing of hypotheses, the preparation of scientific works, papers and statements at meetings and symposiums.... "You constantly feel yourself in debt, and time itself is the creditor. Possibly, for precisely this reason the most accurate clocks have appeared so that time is not spent in vain..." smiles Veniamin Pavlovich.

10272

CSO: 1814/172

## PATENTS AND INVENTIONS

### BETTER USE OF TECHNICAL, PATENT INFORMATION URGED

Moscow EKONOMICHESKAYA GAZETA in Russian No 22, May 85 p 5

[Article by L. Shchelkanovtsev: "The Technical Level of Developments"]

[Text] The All-Union Conference held in Moscow on investigating the technical level of developments on the basis of patent and other scientific-technical information has drawn to a close. This conference was organized by the State Committee for Inventions and Innovations and the Central Council of the VOIR [All-Union Society of Inventors and Innovators] together with the GKNT [State Committee for Science and Technology], the USSR Gosplan, the USSR Academy of Sciences and Gosstandart [State Committee for Standardization].

At the plenary and section sessions, over 60 papers and statements were heard devoted to the questions of documentation research, to improving intradepartmental expert evaluation of technical objects, and to calculating the main indicators for the technical level of the production methods being developed and the major types of products. In the course of their discussion both systems-wide questions of accelerating scientific-technical progress and research on the future level of technology and many special questions of the organization and methodology of information research for evaluating and raising the role of scientific and engineer developments were discussed.

Chief attention was devoted to patent research making it possible to reliably determine the world level which must be achieved or surpassed in developing and putting a product into production.

Such research according to the standards existing in the nation should be carried out in all the stages of developing new technology. Unfortunately, as was pointed out at the conference, the obligation of doing so has not been achieved in the development stages and the information support for these is generally one of the weak points. This research is not always checked in working out plans for the development of science and technology both in the sectors and at the enterprises. Because of this the deficiency of the technical level in a product is discovered too late.

The conference participants were unanimous in the fact that the labor collectives and the scientific research organizations in the sectors must focus not on the reproduction of known models, not on repeating them, but rather on working out qualitatively new machines and production processes the level of which

would surpass the world one. The intensive use of the backlog of inventions under present-day conditions, the conference participants emphasized, will become a key means for accelerating scientific and technical progress.

The recommendations of the all-Union conference reflected many of the discussed proposals aimed at improving the organization of information research and its use for evaluating and encouraging the creative collectives to achieve a high technical level of developments making it possible in a short period of time to reach the most advanced scientific and technical positions.

10272

CSO: 1814/174



## PATENTS AND INVENTIONS

### GREATER ROLE FOR INVENTIONS IN INCREASING EFFICIENCY URGED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 May 85 p 1

[Editorial: "On the Basis of Inventions"]

[Text] "There is no analog in world practice...." When the level of development makes it possible to draw such a conclusion, this means that the developers of the new equipment, production method or material have succeeded in taking a qualitative step along the path of progress. But the newness of an idea is only one of the conditions. In order for a development to be recognized as an invention, it should also provide a significant national economic effect. This is why the extensive use of inventions is the direct path to solving a most important task posed at the April (1985) Plenum of the CPSU Central Committee, that is, to achieve the reequipping of all sectors of the national economy on the basis of modern scientific and technical achievements capable of increasing labor productivity many-fold.

The effectiveness of innovations developed on the basis of inventions can clearly be seen from the work which this year was awarded the prizes of the USSR Council of Ministers. Among the winners is a large group of scientists and production workers who have developed high-precision non-resharpenable plates from hard alloys for cutting tools. Some 54 certificates of invention confirmed the newness of proposed ideas due to which the strength and productivity of the tool has been increased by 2.5-fold. Designed for such progressive equipment as automatic lines, machine tools with numerical control and flexible production systems, this has made it possible to conditionally free more than 32,000 machine tool workers and save 1,800 tons of scarce tungsten. The average annual economic effect from its introduction has exceeded 26 million rubles.

There are many similar examples: tens of thousands of innovations each year are recognized as inventions. But, unfortunately, as an average only one-third of them finds practical employment. Often this is after 3-5 and more years since development and during this time we actually lose the effect promised by these innovations. At the same time in the plans for new technology of a number of sectors, the proportional amount of inventions is inacceptably small. For example, as was shown by an analysis made by the State Committee for Inventions and Innovations, in the plans of the Ministry of Construction Materials Industry, the Ministry of Machine Building for Light and Food Industry and Household Appliances, the Ministry of Automotive Industry and the Ministry of Construction, Road and Municipal Machine Building, the share of developments based on inventions does not exceed 25 percent.

The opinion of specialists is unanimous: it is essential to eliminate this gap between invention activities and new equipment plans and see to it that all long-range developments and the reconstruction and reequipping plans be based on inventions. The solving of this problem depends not only upon the workers from the ministries and departments. The appearance of a future machine, production method or new production line is determined at the level of the scientific research institute, design bureau or enterprise. Hence, precisely here with the aid of the scientific and technical community and the councils of the VOIR [All-Union Society of Inventors and Innovators], with the constant attention from the party organizations, an atmosphere should be established of intolerance for backward technical ideas. Conversely, fundamentally new and promising ideas should gain every possible support and immediately be taken up. It is essential to raise the role of patent research which helps ensure a high technical level of the developments and surpass the best world achievements.

For now such an approach has not become the norm. At the meeting held at the CPSU Central Committee with economic leaders, specialists and scientists, in particular, it was pointed out that the workers of certain head scientific research institutes have impeded the introduction of innovations arising outside the walls of their institute. There have been frequent instances when instead of using an "alien" invention, a great deal of effort, money and time is spent on solving a long-solved problem. One of the reasons is well known: in order that the idea of the developers acquire flesh and blood, scores and hundreds of people assisting in the introduction should not merely perform a certain job but also show a truly creative approach, boldness of thought and purposefulness. The existing practice of commending these persons and assessing their contribution is clearly far from perfect. For this reason, many readers in their letters to the editors have voiced the opinion that the workers of the State Committee for Inventions and Innovations, the GKNT [State Committee for Science and Technology] and the other concerned departments should work out and introduce those indicators and incentives whereby the interest in introducing "alien" inventions would in no way be lower than their own ones.

Of course, this measure alone will not eliminate all the difficulties on the path of technical innovations. A fundamental solution to the problem of introduction is largely linked to the further improvement of the economic mechanism. But a great deal can be done now. This is clearly demonstrated by the action "From Invention to Introduction!" within which the editors of SOTSIALISTICHESKAYA INDUSTRIYA, the GKNT, the State Committee for Inventions and Innovations, the Central Council of the VOIR and the USSR VDNKh [Exhibit of National Economic Achievements] assumed control over the carrying out of 11 major developments. It turned out that publicity and the attention of the broad community help eliminate many barriers and find points of common interest among the partners and reserves for introducing promising innovations.

In order to accelerate the introduction of the most important inventions of intersectorial significance, the USSR Gosplan together with the GKNT, the AUCCTU, the USSR Academy of Sciences and the State Committee for Inventions and Innovations recently adopted a decision to establish an interdepartmental commission. In examining numerous proposals, it should recommend the most effective of them for incorporation in the national economic plans. The attention of the technical administrations and party committees under the ministries must be drawn to

the work of this commission and a similar practice used in selecting inventions within the sectors.

At present, when the nation is approaching the 27th CPSU Congress, the party views an acceleration in scientific and technical progress as the basis for a further strengthening of the nation's economic and defense might and for increasing the prosperity of the Soviet people. In a short period of time we should emerge on the foremost heights of labor productivity, product quality and production efficiency. From the standpoint of this demand, the extensive use of inventions must be considered a major task.

10272

CSO: 1814/171

## CONFERENCES AND EXHIBITIONS

### MOSCOW MEETING ON INTRODUCING SCIENCE INTO PRODUCTION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 21 Apr 85 p 2

[Article written up by the Section for Science and Technical Progress of SOTSIALISTICHESKAYA INDUSTRIYA: "On the Boundary With Production"]

[Text] How to make the interaction of science and production more effective was the question discussed at a meeting of scientists and production workers organized by the editors of SOTSIALISTICHESKAYA INDUSTRIYA and by the Oktyabrskiy party raykom of Moscow.

It was with good reason that the editors' guests were representatives of Oktyabrskiy Rayon. Here is located the Presidium of the USSR Academy of Sciences and there are 36 academic institutes, 47 sectorial ones and 4 major VUZes. Last year alone, their co-workers were responsible for 6 scientific discoveries and over 1,300 inventions. Many of the scientists' developments were introduced for the first time at one or another of the 32 industrial enterprises in the rayon. In a word, the rayon has gained a good deal of experience in the interaction of science and production. Also well known here are those problems which complicate this.

"The economic effect from introducing scientific and technical innovations at the rayon's enterprises last year was 506 million rubles," said the secretary of the Oktyabrskiy party raykom, I. Danilov, in opening the meetings. "Not a bad result. But with more advanced planning of introduction, I feel that this could have been significantly better. In becoming acquainted with the practices of certain enterprises, one cannot help but focus attention on the lack of comprehensiveness in carrying out a technical reequipping. They willingly employ specific partial solutions while fundamental innovations are introduced with great difficulty. Hence the insignificant effect. The specialists from enterprises and their scientific partners would probably agree that this is primarily their failing. But the ministries too, in assigning funds for reconstruction, at times see this in the sense of just eliminating "bottlenecks." Much less of a concern with increasing production efficiency to a qualitatively higher level....

It is precisely on the enterprise level, in being embodied in new machines, equipment and production processes, that scientific discoveries become a productive force. But why are production workers not always in a hurry to take them up?



"Let us immediately clarify: about what scientific achievements are we talking?" said the chief engineer of the Machine Tool Plant imeni S. Ordzhonikidze, Ye. Voronichev. "The enterprises can resist when it is essential to develop a new product and there are objective reasons for this. Who would refuse innovations which help meet the plan, reduce labor expenditures or save metal, energy or fuel?"

In line with this the question arose of scientific and technical information. The traditional flow of information about individual machines, instruments and materials more and more often does not satisfy the specialists. In the opinion of those who spoke, the system of scientific and technical information should provide an answer where the problem confronting production is being solved or has been solved, what research and development is being carried out in this area, when will it be completed and when will the series production of the innovation start.

There were also other opinions, for example, it is dangerous to rely on an innovation in the development stage as the period of development for their production is often not met and for this reason they prefer to include in the reconstruction and reequipping plans far from new and even already-produced equipment. There are also other reasons for this.

"According to the existing procedure the technical reequipping plans are approved 2 years before the start of the work," said the deputy chief engineer of the 2d GPZ [State Bearing Plant], V. Vasin. "But 2 years is a long time as some things can become obsolete and more efficient ideas appear. However, it is almost impossible to make changes in the plan. If an enterprise still does make them, they will not be financed. It turns out that we knowingly set ourselves back a year or two. We feel that the system for planning and financing technical reequipping should be more flexible and provide the enterprises with greater independence within the amounts of allocated funds."

The discussion of the technical reequipping plans attracted universal attention. What strategy should underly such plans?

"They should be based upon comprehensive ideas and a vision for the future," felt the Director of the Institute for Information Problems of the USSR Academy of Sciences, Academician B. Naumov. "In other words, the reconstruction and reequipping plans should be thought out in such a manner that each regular innovation introduced would not merely add something to the previous results but, putting it figuratively, would multiply the previously obtained effect. For example, at present the enterprise can receive numerical controlled machine tools, tomorrow control can be turned over to a universal computer and in the subsequent stage linked up by a transport system. Ultimately to obtain a flexible complex of equipment which possesses 2-5-fold more productivity. Certainly the question is who should work out such plans and designs?..."

"The existing enterprise subdivisions cannot handle this as they are focused on routine production matters," said V. Vasin. "One might ask what we should do? We are attracted by the idea of temporary scientific and production collectives. In these we could bring together not only the most capable of our specialists but also invite in scientists. But no provision is made in the standard enterprise structure for temporary collectives. This question must be resolved...."

"The Institute of Chemical Physics Under the USSR Academy of Sciences," said the Scientific Secretary of the Institute and Candidate of Physicomathematical Sciences, S. Tsyganov, "has rich experience in cooperation with industry. There are professional contacts with the ministries and the sectorial scientific research institutes. The scientists do not avoid collaboration with the individual enterprises where the promise of their proposals is tested out in practice. Alas, even the highest results frequently do not open up the way to broad introduction."

The situation is no better with the introduction of developments carried out within the VUZes, although they, seemingly, stand closer to industry.

"In endeavoring to resolve this problem, over the last years we have tried out the most diverse forms of cooperation with production," said the Rector of the Moscow Steel and Alloys Institute, Prof N. Khavskiy, at the meeting. "In our view, the most promising of these is the sectorial laboratories established in the VUZes and financed by the ministries. At our institute they are responsible for around 60 percent of the questions being carried out by economic contract. Of course, here there are no guarantees. There is merely the hope that the results of the research will become known in the sectors. Sooner or later they will find application. For now scarcely 80 percent of the developments carried out under economic contracts have been introduced at one or two enterprises, although they could be employed at many of them."

Last year, the leaders of the Union Minvuz [Ministry of Higher and Specialized Secondary Education], Minchermet [Ministry of Ferrous Metallurgy] and Mintsvetmet [Ministry of Nonferrous Metallurgy] signed a joint order. In accord with this, over a short period of time, within 2 years, 23 of the most promising institute developments should be introduced at 11 major enterprises. Even now it can be seen that the orders have noticeably and to the better altered the attitude of the enterprises to innovations. It is not even a question that the course of the work is being monitored by the ministry personnel as the production workers have felt that they are doing a major deed for their sectors. After testing out the innovations, they go to other enterprises.

Of course, such joint orders are but a partial solution to the problem. In order to solve it completely, by legislation it is essential to establish the responsibility of the sectors for prompt introduction and establishing the run of innovations, emphasized N. Khavskiy.

"What do you consider 'by legislation'?" asked the Director of the All-Union Scientific Research Institute for Drilling Equipment, Doctor of Technical Sciences, Yu. Vadetskiy.

"Certainly, for example, is not a decision by the Union gosplan, a law in the sphere of economic management? But certain ministries which manufacture innovations avoid this under various pretexts. Then neither the efforts of the developers nor the interests of the consumers can guarantee its wide introduction."

As an example, the scientists gave one of the institute's developments, a new turbodrill developed several years ago which increases the rate of well drilling.

But the Minkhimmash [Ministry of Chemical and Petroleum Machine Building] did not organize series output of the innovation. Only after action by SOTSIALISTICHESKAYA INDUSTRIYA did things get off dead center.

How can one surmount the barrier of the "third partner," the manufacturer?

"With the existing procedure," said Yu. Vadetskiy, "the client ministry which is interested in employing new equipment turns to the gosplan and the latter issues an order to the manufacturing ministry to develop its production, allocating the corresponding funds to it for this. And here a paradoxical thing occurs: the client is actually turned...into the consumer who should wait calmly for the start of series output. I feel that the responsibility of the manufacturers would be noticeably increased if the financing of development for series output of new equipment would be carried out through the client. Incidentally, the client would have the right to choose its partner...."

It is also essential to raise the responsibility and interest of the very enterprises which manufacture the new product. In assessing the results of enterprise operations," emphasized Doctor of Philosophical Sciences, Prof V. Smol'kov, the quality aspect is weakened.

Probably many readers already know about the experience of one of the leading collectives in Moscow's Oktyabrskiy Rayon, the Krasnyy Proletariy Production Association. In the place of obsolete universal machine tools here they have installed half as much but modern equipment, using the advantages of flexible production methods. As a result the production volume has increased by almost 1.5-fold. The machine tool builders of the Plant imeni Ordzhonikidze, the colleagues of the Krasnyy Proletariy workers have drawn the appropriate conclusions from this.

"We can produce a thousand regular machine tools and fulfill the plan," said Ye. Voronichev. "But with the same capacity we can also make 500 machines embodying the latest scientific achievements. In the national economy they will produce a much greater effect than the 1,000 ordinary ones. But then what will happen to our plan which continues to be reckoned for us in units and rubles of gross product? The conclusion, I feel, is clear: in order that the enterprises be interested in developing the scientific and technical achievements, their activities should be judged from the effect which the produced product provides in the national economy...."

Academician B. Naumov who supported the chief engineer of the machine tool plant saw broader opportunities for his proposal.

"Only the end national economic effect can be the criterion for assessing any of our efforts, be this a scientific development, a machine design or the production of any equipment," he emphasized. "Proceeding from what effect we wish to obtain, the tasks of scientific and technical progress should be formulated. And this must be done with maximum care, providing for all stages of work, who will carry them out and the necessary support."

In the scientist's opinion, only a specific program method tested out, for example, in nuclear and space problems, can serve as the guarantee for the successful carrying out of our tasks. And primarily the most important ones.

"Probably not all of the voiced opinions and proposals are indisputable," said I. Danilov at the conclusion of the meeting. "But one thing is clear: in carrying out the tasks of scientific and technical progress, we can no longer rely merely on initiative, awareness and party responsibility of the leaders. In order to bring about a major turn to the path of intensification, it is essential to develop a mechanism of mutual economic interest for science and production in the end results."

In publishing the report on the business-like meeting, the editors invite scientists and production workers as well as management personnel to continue the discussion of the ways for accelerating scientific and technical progress.

10272

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GENERAL

ACADEMICIAN KOPTYUG INTERVIEWED ON SIBERIAN SCIENCE

Moscow TRUD in Russian 21 Apr 85 p 3

[Interview with Academician V. A. Koptyug, vice president of the USSR Academy of Sciences and chairman of the Siberian Division of the Academy of Sciences: "The Creators of Progress"]

[Text] Our correspondent met the Vice President of the USSR Academy of Sciences and Chairman of the Siberian Division of the Academy of Sciences, Academician V. A. Koptyug at the Hall of Columns at the House of Unions at a ceremony devoted to Soviet Science Day. After a speech, Valentin Afanas'yevich [Koptyug] agreed to give an interview.

[Question] Valentin Afanas'yevich, from your speech one could realize that you are proposing a new approach to introducing scientific and technical achievements into production.

[Answer] Siberian scientists feel that it is essential to manage introduction of new products and this must be done on a planned basis. Only then is it possible to control the course of introduction. Using a specific example we showed the feasibility of such an approach. During the period of drawing up the plans of the 12th Five-Year Plan, the Siberian Division carried out a unique inventorying of the results of the completed scientific research and experimental design work. A list of 186 major developments with detailed annotations was forwarded to the USSR Gosplan, the GKNT [State Committee for Science and Technology], the RSFSR Council of Ministers, the RSFSR Gosplan as well as 62 Union ministries and departments. We have proposed a review of the list in the aim of widely employing this work in the national economy during the 12th Five-Year Plan. In December of last year the USSR Gosplan approved the decree "On Measures to Accelerate the Introduction of Research Results of the Siberian Division of the USSR Academy of Sciences into the National Economy in 1986-1990." It pointed out the great national economic significance of the developments submitted by us and outlined specific ways to implement them.

[Question] In other words, the fundamental research of the Siberians at present is more quickly finding practical employment.

[Answer] Of course. The potential of scientific developments which has been acquired in recent years and is constantly being added to comprises that basis

which makes it possible to carry out work on a broad front in applied areas in the interests of the national economy and primarily the Siberian economy. Siberian scientists are taking an active part in all large-scale actions which alter the face of the region.

One of the vivid examples is the establishing of the Western Siberian oil and gas complex and the turning of it into the nation's main fuel base. In 1965, the first million tons of oil were produced here and in 1984 the figure was around 312 million tons, or more than 60 percent of the total output of oil and gas condensate in the nation. A similar jump has also occurred for gas: the first billion m<sup>3</sup> in 1984 and 315 billion just 10 years later. And this is over 50 percent of all the gas output. The work of scientists from our division has played an important role in this progress.

Another event of enormous economic and sociopolitical significance will be the completion of the Baykal-Amur Mainline [BAM]. For coordinating the scientific research related to the construction of the BAM and the economic development of the adjacent zone (more than 1.5 million km<sup>2</sup>), in 1975, under the Academy of Sciences the Scientific Council for the Problems of the Baykal-Amur Mainline was established and its membership, along with Moscow scientists, included many prominent scientists from Siberia and the Far East. The council coordinates the work of over 180 scientific, scientific-research and design subdivisions in the nation.

Quite recently approval was given to still another proposal which was worked out by the council. The Politburo of the CPSU Central Committee upon submission by the USSR Gosplan, approved the construction during the 12th and 13th Five-Year Plans of a railroad line which would connect Berkakit Station on the BAM with the city of Yakutsk. The scientific principles were worked out and a plan prepared for the specific integrated program of economic development in the BAM zone over the long run. These scientific preplanning materials are being employed by the RSFSR Gosplan and the USSR Gosplan in working out the basic indicators of economic and social development for the BAM zone during the five-year plans.

An equally vivid example of the broad practical introduction of fundamental research results is the whole series of radiation technologies which employ the charged particle accelerators developed by the Nuclear Physics Institute. This is the production of heat-set pipe for a number of industrial sectors and heat-set sleeves for large-diameter oil and gas lines, radiation disinfection of grain and much else. Just at the enterprises of the Minelektrotekhprom [Ministry of Electrical Equipment Industry], the accelerators have already provided an economic effect of 140 million rubles.

The development of the theory of rapidly-occurring processes by the school of Academician Lavrent'yev, including those of an explosion, has given rise to an entire cascade of technological solutions for the most diverse production sectors. These include strengthening, welding and stamping of metal products, explosion pressing of powders, the removal of spurs from parts and the applying of strengthening surfaces using detonation waves, the explosion pressing method in installing high-voltage power lines, the vortical-powder method of extinguishing fires at oil and gas deposits.

[Question] Which of the fundamental theoretical studies of the Siberian Division completed last year do you consider to be the most significant?

[Answer] It would be possible to give very many examples from the actual work of our division's institutes. At present, a broad scope and high level of fundamental research have been achieved not only in Novosibirsk but also in other Siberian scientific centers.

Let me mention just one of these -- the joint work of the Moscow and Siberian scientists the results of which have recently been recognized as a discovery by the USSR Goskomizobreteniy [State Committee for Inventions and Discoveries]. It is a question of the influence of magnetic fields on the occurrence of certain types of chemical reactions. It has always been felt that the energy of a magnetic field is so slight that it would be unable to influence any chemical processes. It turns out that it can. In the laboratories of the nation and the world, strict experiments have been set up which shows the presence of a reproducible effective influence. The theoretical explanation for this has been found. It now makes it possible to predict when such effects can be observed and at the same time to give some thought to where and how they might be employed. In particular, the opportunity has arisen of creating new, extremely effective methods for separating isotopes. Another exceptionally interesting and promising area is to study the influence of magnetic fields on biological objects as certainly biology and chemistry are directly related. Already much has been written about the magnetic "miracles," and at present there is the possibility of separating the truly valuable results from all others and employ these in the interests of man.

The necessity of the more rapid development of fundamental research has been emphasized in the decisions of the 24th, 25th and 26th Party Congresses. Attention to this question is fully understandable, since precisely the results of fundamental research ultimately determine society's scientific potential and are the source of new technical and technological ideas leading to revolutionary changes in various spheres of production.

10272

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GENERAL

EFFECTIVENESS OF INTEGRATED RESEARCH--DEVELOPMENT TRACED

Moscow PRAVDA in Russian 26 May 85 p 3

[Article by Yu. Pozhela, president of the Lithuanian Academy of Sciences, Vilnius: "A Bridge to Innovation; The Routes of Technical Progress"]

[Text] If one would endeavor in a single word to describe the main particular feature of modern products and production methods, it could be said that they are becoming more and more science-intensive. The qualitative upgrading of products and the methods of producing them require the use of mathematical methods and computers as well as the most recent accomplishments of physics, biology and chemistry. And this means that any sector of the national economy requires a multilevel scientific servicing, and also on the level of fundamental research.

The organization of such intersectorial cooperative centers at present determines scientific and technical progress in the national economy. In recent years, Lithuania has tried out various forms of organizing multilevel cooperation among the academy and sectorial institutes as well as the industrial enterprises of the region.

Thus, the Institute for Chemistry and Chemistry Technology Under the Lithuanian Academy of Sciences has achieved major scientific achievements in fundamental research on electroplating processes. On the basis of them a number of production methods has been developed and these are already employed by over 820 major enterprises in the nation. Among them are such giants as the VAZ [Volga Automotive Plant], KamAZ [Kama Automotive Plant] and others. Annually this provides them with a savings of over 15 million rubles. And it is not only a matter of savings. At present the institute largely determines the efficiency and level of electroplating methods in all machine-building sectors of industry.

The success of introducing the new production methods is determined by the completeness of the institute's developments which are tested out on a semiproduction scale in experimental production. Moreover, many enterprises in the nation have formed interdepartmental laboratories and groups which bring the methods to their enterprises. Certain ministries together with the institutes have established model electroplating production and this has become the basis for the sector in introducing new production methods.



The Elektronika [Electronics] Scientific-Production Complex can serve as an example of organizing multilevel cooperation among the academy and sectorial scientific institutions and most diverse areas of production for solving another sort of problem, that is, the automation and robotization of production using computers and for developing new products for semiconductor and radioelectronic equipment. It includes two academy institutes, four sectorial ones, two VUZes and ten plants.

This group has been established as a permanent alliance of specialists: on the one hand, physicists and mathematicians, and on the other, engineer developers and producers of radioelectronic equipment. It is based on the research, production and engineering subdivisions of the scientific research institutes, the plants and academy institutes which complement one another. In the nation one will find few such scientific-production centers with so strong and universal a base and highly skilled personnel as is found in Elektronika.

It is important to point out that here they have set as their goal the employing in production, regardless of its departmental affiliation, of fundamental knowledge and technical achievements and not only introducing "their own" scientific developments into practice.

All the organizations benefit from participation in the group and the membership of Elektronika has been constantly growing. Over the 2½ years of its existence the group has carried out over 100 developments which have provided over 5 million rubles of savings just for the organizations comprising the NPK [Scientific-Production Complex]. At present, another 16 major projects are being carried out. Among them is the elaboration of ASU [automated control system] and microprocessor equipment for controlling the production of cine-scopes at the Panezhivis Ekranas Plant and television equipment at the Shyaulyay Television Plant imeni 40-letiyе Sovetskoy Litvy, the improved quality and technical level of producing television sets, the development of specialized integrated circuits and semiconductor sensitive elements (sensors) for machine tool building and electrical engineering enterprises, the development and introduction of machine designing of radiometering and electronic equipment, the development and production of new radioelectronic equipment for medical diagnosis and so forth.

The work carried out at Elektronika does not end with the manufacturing of individual models and samples but is taken to the stage of experimental production of small series. The Vil'nyale-2 and Vil'nyale-3 microcomputers developed by the joint efforts of the Semiconductor Physics Institute, the Mathematics and Cybernetics Institute of our academy, by the sectorial institutes and the Shyaulyay Television Plant with their software are being used in enterprise shops.

The effectiveness of cooperation between the academy facilities and the other organizations of Elektronika is determined by the existence of a number of specialized enterprises under the republic academy institutes.

The main particular feature of these enterprises is their good scientific support. This is a concern not only of the head institutes but also the sectorial institutes and design bureaus of the Elektronika enterprises, where the most

complicated assemblies of the plant products are worked up and developed. Such cooperation makes it possible to develop the most complicated scientific instruments and semiconductor devices as well as provide high-quality software. These enterprises have actually become centers for scientific servicing of national economic needs at the enterprises of not only Lithuania but also the other Union republics.

Socialist production at present demands from science not only industrial technology but also complete scientific servicing in resolving the questions of economic and social development. The Lithuanian Academy of Sciences together with the Shyaulay party gorkom and the goriapolkom have organized the comprehensive servicing of the production and training organizations of the city. This involves sociologists, botanists, power engineers, physicists, economists, historians and parasitologists. Around 50 laboratories from virtually all the institutes of our academy have carried out over 150 projects of varying sorts. Intersectorial laboratories and groups have been organized at the city enterprises and these have made a substantial contribution to improving production effectiveness and labor productivity. The results of introducing the developments of scientists from the republic academy of sciences have contributed over one-third of the entire economic effect gained by city industry from new equipment.

The experience of organizing multilevel cooperation among the scientific, design and production organizations from different departments in the republic indicates that its effectiveness is determined by the active involvement of the party and soviet bodies in organizing and managing the coordinating interdepartmental bodies operating on volunteer principles as well as by the setting up of professional interdepartmental laboratories and production lines which are specialized in terms of scientific sectors and not in terms of production sectors.

Precisely the production subdivisions under the scientific leadership of the academy and other scientific and design organizations in the republic have become the crucial element providing scientific servicing for all the region's organizations. I feel that it would be advisable to broaden the experience of establishing such types of production.

10272

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GENERAL

ACADEMICIAN DESCRIBES ACHIEVEMENTS OF ESTONIAN SCIENCE

Tallinn SOVETSKAYA ESTONIYA in Russian 20 Apr 85 p 3

[Article by S. Kalabin: "Yesterday a Miracle, Today a Reality"]

[Text] The prominent Soviet physicist, the Corresponding Member of the USSR Academy of Sciences, Academician of the Estonian Academy of Sciences and President of the Estonian Academy of Sciences, K. Rebane, has described to the ETA [Estonian Telegraph Agency] correspondent the scientific achievements in the republic.

The problem of the genesis and evolution of the universe and the "organization" of the world surrounding us, said K. Rebane, has been and remains one of the most stirring problems confronting science. Estonian astrophysicists headed by the Corresponding Member of the Estonian Academy of Sciences, Ya. Eynasto, have made a contribution to its unraveling.

They have discovered that giant accumulations of galaxies and supergalaxies the dimensions of which reach hundreds of millions of light years form in the universe a cellular structure like soap bubbles. But we observe only a small portion of the mass of stellar systems. In the "cells" of the universe is concealed, in the opinion of scientists, "invisible matter" in the form of elementary particles of neutrinos.

If it will be confirmed, pointed out K. Rebane, that in its mass the neutrino surpasses by many fold the total mass of ordinary visible matter in the universe, then it can be asserted that the basic mass of matter in the universe will be contained in neutrinos. And the visible matter of the galaxies comprises only a slight addition. The source of the concealed mass of the galaxies, the neutrinos, will become understandable.

Nature is uniform in its manifestations. For this reason, in observing the celestial sphere, we can today also penetrate the secrets of the microworld and the inner structure of elementary particles. Moreover, the large-scale structure of the universe as discovered by Estonian scientists "will preserve the memory" of the state of the universe when the world was an unimaginably small, hot, dense cluster of plasma. Physicists are endeavoring to "look" even farther and describe the state of the universe at the very start of the first second

after the "big bang." Today we can even provide a natural scientific explanation for certain processes which yesterday were hard to imagine. In rephrasing the words of the queen in "Alice in Wonderland," it could be said: "There are miracles next to which that which seemed a miracle to you yesterday, today will seem simple and understandable as a dictionary."

The success of the astrophysicists is clear proof of the high level of fundamental research which has been reached by scientists from the Estonian Academy of Sciences which was established under Soviet power. There are many such examples to the credit of our scientists. They have also reached leading positions in the area of developing computer memory equipment, in precision organic synthesis, the integrated use of the natural wealth of Estonia, shale, and considering environmental conservation, as well as in studying the waters of the Baltic and with the launching of the research vessel "Arnol'd Veymer," also the ocean expanses. Recently the Institute for Chemical and Biological Physics completed measuring the mass of helium and hydrogen isotopes with record accuracy, that is, amounts which are of crucial significance for measuring the rest mass of neutrinos. Thus, Estonian scientists have approached the unraveling of the secret of latent mass from the other side.

Today the names of the academicians of the Estonian Academy of Sciences E. Lippmaa, O. Eyzen, I. Epik, the corresponding members of the Estonian Academy of Sciences A. Aarn, Yu. Lille, V. Pal'm and Doctor of Chemical Sciences, K. Leets are widely known both in our nation and abroad. This can be seen also from the frequent references to the works of our famous researchers. Following them is a worthy new shift such as the winners of the Lenin Komsomol Prize P. Saari and Ye. Berik as well as other young republic scientists who have achieved many successes in science.

But fruitful scientific exploration is possible only under the conditions of stable peace. said in conclusion K. Rebane, a member of the Committee of Soviet Scientists for the Defense of Peace and Against the Threat of Nuclear War. For us, the experts, it is clear how dangerous are the illusory plans of the American strategists of "star wars" to blaze a trail through space to military supremacy. Certainly it should be understood that the USSR, the first to go into space, now will be able to take measures to dependably repel the threat from space.

10272

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GENERAL

ADVANCES OF MOLDAVIAN AGRICULTURAL SCIENCE REVIEWED

Kishinev SOVETSKAYA MOLDAVIYA in Russian 20 Apr 85 p 2

[Unattributed article written up from letters: "...A Productive Force"]

[Text] What are the problems that the republic scientists are now working on? How are they celebrating their professional holiday? Responding to the request of the SOVETSKAYA MOLDAVIYA correspondent are:

S. Toma, director of the Institute of Plant Physiology and Biochemistry Under the Moldavian Academy of Sciences and academician of the Moldavian Academy of Sciences.

The collective of our institute is at work on the problem of the physiological and biochemical bases for the adaptive capacity and productivity of agricultural crops under the conditions of intensification and large-scale production concentration. It is also working out the scientific bases and practical recommendations in the aims of reducing the losses of fruits, vegetables and grapes in their extended storage and long-distance transporting.

What, speaking specifically, have we been able to accomplish in recent years? The Laboratory for Plant Agroecological Physiology has developed, tested and proposed to the Scientific-Technical Council of the republic Minsel'khos [Ministry of Agriculture] recommendations on the rational placement of regionized grape varieties on hillside lands, depending upon the winter resistance of the plants. These recommendations are already being employed by the Kolkhozsadvinproyekt [Kolkhoz Orchard and Vineyard Design] Institute in designing new commercial vineyards. Recommendations have also been widely employed on using microfertilizers on producing vineyards along with mineral fertilizers; these have been worked out by the plant nutrition laboratory.

The efforts of the institute's scientists have been concentrated on solving such a major problem as increasing the drought, heat and winter resistance of fruit crops and grapes. Theoretical research by the institute's co-workers have become the basis for studies of an applied sort. These include instruments for determining the drought resistance of plants and the diagnostics of irrigation times for intensive-type orchards and a method for obtaining seedling material for stone fruit crops having increased drought resistance. A method has been

worked out for forecasting the frost resistance of winter crop and barley plants and this is suitable for use in breeding work.

Great attention has been given to the problem of reducing crop losses in storage and transporting. Methods have been found for the diagnostics of the storability of fruit as well as for determining the types for picking apples and pears. The use of these recommendations will make it possible to obtain annually an economic effect totaling more than 100 rubles for every ton of product raised.

The institute's collective is making every effort to carry out the tasks confronting them, to successfully complete the quotas of the 11th Five-Year Plan and properly greet the 27th CPSU Congress.

#### Editorial Information

The Moldavian Academy of Sciences at present includes 17 scientific institutions where research is being conducted on 82 problems in the area of natural and social sciences. Although the academy is responsible for only 12 percent of the total number of the republic scientific workers, it possesses a powerful scientific potential employing over 800 doctors and candidates of sciences.

Many of the scientific developments are characterized by fundamental newness. Just in 1981-1984, academy scientists received 534 certificates of invention. During the current five-year plan, over 550 developments were introduced into the economy. The total economic effect from their use was 66 million rubles.

B. Mel'nik, dean of Kishinev State University imeni V. I. Lenin and academician of the Moldavian Academy of Sciences.

Two focuses characterize university science: one "potentiates" future progress, providing it with personnel and turning over to the economy scientific developments based upon a sound theoretical foundation.

We link the emphasis on scientific problem studies with direct participation of the scientists in research work. Around 6,000 students are engaged in scientific work according to the subjects of the chairs and problem laboratories and 245 of them are carrying out their own developments according to enterprise orders.

The university has not remained on the sidelines of the problems caused by the reform in the general educational and vocational schools. A number of new textbooks have been written for the students, the reissued textbooks are being supplemented and educational-procedural aids have been worked out for the teachers in various subjects.

Mathematical scientists have taken an active part in realizing the problem of computerizing the schools. A software program has already been worked out entitled "Shkol'nik" [School Pupil] in Russian and Moldavian and this will make it possible in the 9th-10th grades to give the course "Principles of Information and Electronic Computers."

The second "focus" of university science, as was stated, is related to national economic tasks. At present, our chairs and laboratories are linked by contracts

for scientific and technical collaboration with more than 50 enterprises. Each year research totaling over 2 million rubles is carried out under orders from the enterprises and institutions within economic contracts and affiliates of our chairs are working in 7 republic organizations.

All of this makes it possible year by year to increase the practical return from university science. Last year, for example, we broadened the area planted by high-menthol mint and this produced a net income over 800,000 rubles.

The crop raisers of the republic evermore widely are utilizing the soil-reclamation maps and proposals for draining waterlogged land. By the end of the five-year plan over 2,000 hectares will be put into agricultural use.

At the Scientific Research Institute for Electric Instrument Building Under the Mikroprovod [Microwire] NPO [Scientific-Production Association], recommendations have been introduced for improving the methods of microwire casting. Here are several other figures: just last year we obtained around 70 certificates of introduction, university scientists received 20 medals and diplomas of the USSR VDNKh [Exhibit of National Economic Achievements], and more than 50 certificates of invention were obtained.

Still the return from our scientific potential could be even higher. The way to this is the further strengthening of ties between academy and sectorial science and production.

#### Editor Information

The scientific and pedagogical personnel comprise the basis of scientific potential in the republic's higher school. Over 4,000 professors, instructors and co-workers from the special-problem laboratories are now working within the VUZes. Each year the scientists turn over to the national economy up to 200 completed scientific developments. Their economic effect is around 14 million rubles.

Creative ties are being strengthened between the VUZes and the republic enterprises. Last year, 240 contracts were in effect for socialist collaboration, there are 2 training-scientific-production associations and 30 affiliates of VUZ chairs at enterprises.

I. Untila, general director of the "Selektsiya" [Selection] NPO.

Our NPO is involved in working out 7 all-Union comprehensive programs and is conducting research on 4 republic scientific-technical problems for the APK [agroindustrial complex]. Each of them has clearly formulated output parameters for the scientific products. For example, for the first problem the task has been set of developing high-yield varieties of winter and summer ear crops with resistance to bad environmental factors and a potential wheat yield of 80-90 quintals per hectare and for barley 78 quintals per hectare.... Working along with the plant breeders and production engineers on solving the posed problems are geneticists, physiologists, phytopathologists, agrochemists, economists and other specialists. Analogous specific output parameters have been set for the

problems of "sugar beets," "sunflower," and "feed production." Such concretization of the research makes it possible to significantly increase the personal responsibility of each researcher for the quality of the scientific developments.

What have we been able to do on the level of implementing the posed tasks? Over the 4 years of the five-year plan, we have developed and turned over to state varietal testing some 29 new varieties and hybrids of the main field crops. Within the republic and beyond it we have regionized 11 varieties and hybrids. The planted areas covered by our crops are also increasing. For example, last year the planted area under new winter varieties of barley, wheat, soybean, green bean and sugar beets, was over 117,000 hectares. This is largely the contribution of our science associates I. Prokop'yeva, V. Korobko, A. Khingan, I. Litovchenko, I. Koval'skiy and many others.

The scientists are also carrying out diverse work in propagandizing and introducing scientific achievements. They have not limited themselves to publishing scientific works and recommendations but are providing direct aid to the agricultural workers in the fields.

#### Editorial Information

The scientific-production associations are a new form of integrating science and production. At present, there are 12 NPO functioning in the republic APK.

Within the republic sectorial scientific-technical problems, the NPO scientists are at work on developing new varieties and hybrids of farm crops, strains and lines of animals and poultry crosses, and they are also developing and improving industrial technologies and new forms of the organization of labor. Just in 1981-1984, 59 new high-yield varieties and hybrids of grain crops, industrial and feed crops as well as grapes were turned over for state varietal testing. Each year 230-240 developments by scientists from the sectorial institutes are introduced into republic agricultural production and these have provided an economic effect totaling 60-65 million rubles.

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CSO: 1814/174

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